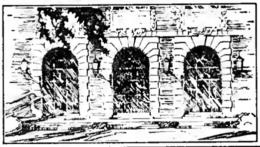

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Atlas of
Illinois
Resources

Section I

Water Resources and Climate

Atlas of Illinois Resources

Section I

STATE OF ILLINOIS
BOARD OF
ECONOMIC DEVELOPMENT

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WATER RESOURCES OF ILLINOIS

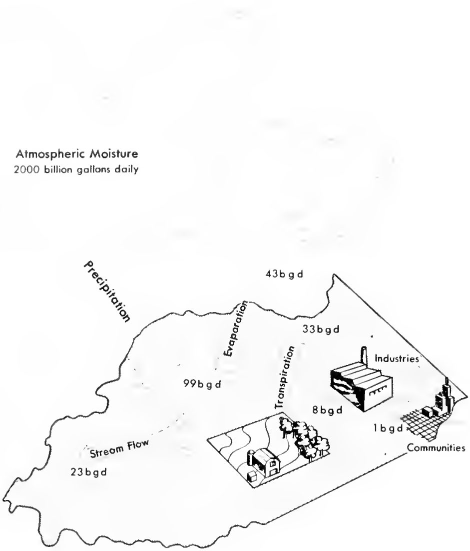
Illinois is a water excess state, which means this resource is available in excess of demand. In fact, the water available to the state is conservatively computed to be at least five times the present usage.

Illinois is almost an island, in a sense being surrounded by fresh water. Along its western border flows the mighty Mississippi and to the south and east are the Ohio and Wabash. Lake Michigan lies to the northeast. This is far from all, for larger supplies are readily available within the state in the form of great rivers such as the Rock, the Illinois, and the Kaskaskia, as well as many smaller streams. Out of sight, but important as sources of water supply, are the ground waters in the soil and in the deep rock formations.

Illinois' water resources are as large today as when this area was a wilderness, and so far as modern science can determine, they will be undiminished and constantly renewed by a great inflow of atmospheric moisture or water vapor in the air which averages 2000 billion gallons (bgd) per day. From this source of moisture the rather inefficient processes of nature cause only about 5 percent to fall as rain or snow, yet this mere 5 percent averages 99 bgd for the state. Evaporation from land and water surfaces and the transpiration from growing plants have first call on this water; together they consume and return to the atmosphere about 76 bgd. Some 23 bgd of stream flow, including ground water, are available from within the state, which, when added to the minimum flow of record on the Mississippi and Ohio, as well as the present pumpage and diversion from Lake Michigan, brings the grand total mean daily surface and ground water supplies available to Illinois to 43 bgd. This is an immense amount of water—five times the present state usage and one-sixth of the water usage for all purposes in the entire United States.

Of course, water is not uniformly available either in place, in time, or in quality. Variations of the water resource are in part due to the great north-south dimension of Illinois, since within this 385 miles of latitude there is variation with respect to storm tracks and in distance from the primary moisture source in the Gulf of Mexico. For these and other reasons, precipitation varies from about 46 inches per year in the Shawnee Hills of southern Illinois to 32 inches in the vicinity of Lake Michigan. Most of this larger precipitation in southern Illinois occurs in the winter season, and about 5 percent of this falls as snow. In northern Illinois about 20 percent of the winter precipitation is snowfall.

Runoff in the form of stream flow varies areally in much the same pattern as precipitation, and if spread over the state would vary in depth from about 16 inches per year in the south to 8 inches in the north. The higher runoff in southern Illinois in conjunction with more rolling or hilly land surface lends itself well to the development of surface water impoundments. Northern Illinois, on the other hand, is more



HYDROLOGIC CYCLE

fortunate in the generally available ground water in unconsolidated glacial material and in the deep rock formations.

As is well known, rainfall and stream flow also vary in time. To an extent these variations are cyclic with the seasons of the year, but wide deviations from the average trend are more the rule than the exception. In addition to the seasonal and day-to-day changes there are the occasional extended periods of excess or drought. The years 1952–1955 constituted such a period of extended drought, not only in Illinois but throughout much of the mid-continent. Once experienced, an extreme period of record such as this becomes an important guide to future engineering planning and design. This drought of 1952–1955 has been the subject of intensive study and it is estimated to have been of a severity which can be expected only once in about 80 years.

Water also varies widely in quality, and this has been and still is the subject of intensive study in Illinois through the analysis and correlation of thousands of water samples each year. Water does not exist in the chemically pure form of H_2O, but

contains dissolved and suspended material from both natural and man-made sources. Also, there is no universally ideal water quality for all purposes. Illinois waters are usually mineralized to a degree, are moderately hard, and may contain iron and various other substances. Two points are important in this regard: information on water quality is available; and chemical, physical, and bacteriological treatment methods are available to adjust any original element of natural water quality within desirable limits.

Complete knowledge for the full and economic development of water resources requires far more than data on rainfall and stream flow. Even the list of closely related physical factors is long. These include topographic and geologic maps for the location of dam sites, and rates of evaporation and sedimentation for the design of reservoirs. Water temperature data are of great importance since the largest single use for water in Illinois is for cooling purposes in industrial processes. Air temperature and wet bulb data are needed in the design of air conditioning equipment, another important use for water.

Present and projected uses for water in Illinois are factors of importance in our water resources knowledge and are subjects of continuing study. Present use of water in Illinois by major user categories is approximately 6 bgd for thermal power stations, 2 bgd for all other industrial applications, 1.4 bgd for municipal use, and smaller amounts for agricultural uses. These growing uses, which presently total some 9.5 bgd, compare with a potential, useful resource of about 43 bgd.

Much of the foregoing discussion on water availability, its character, and its present usage underlines the necessity for detailed water resources information extending over many years and in adequate detail. In this regard Illinois is indeed fortunate, since its water resources have been under increasingly intense study since the creation of the State Water Survey in 1895. This agency, working with the State Geological Survey and other state agencies, has accumulated a wealth of information on the water resources of the state. It has been said that Illinois has better records on its water resources than any comparable area in the world, and this knowledge is vital to the effective development and utilization of the water and other natural resources of the state.

The pages which follow contain a brief but factual summary of water resources, climate, and related data. Through reference to available documents given in the reference list or to the indicated state agencies dealing with water supplies, more detailed information can be obtained. The right to use water is contained in a discussion of Illinois water rights law.

RUNOFF AND STREAM FLOW

Natural surface flow of water is termed runoff. In Illinois, 23 billion gallons of the approximately 100 billion gallons of average daily precipitation eventually run off in streams. The performance of these streams is determined from the study of long periods of stream flow records; the State Water Survey and other agencies cooperate with the U.S. Geological Survey in obtaining continuous records at 161 stream gaging stations within or along the borders of the state.

Stream flow is usually expressed in cubic feet per second. This value is sometimes converted to cubic feet per second per square mile of drainage area, or to inches of runoff. Inches of runoff represents the depth to which a drainage area would be covered if all the flow derived from it during a period of time were distributed uniformly on its surface. This latter term is useful when comparing runoff with precipitation.

The map shows the distribution of mean annual runoff in Illinois as obtained by using the average data for 25 stations. Drainage basins for these stations reach into Wisconsin in two instances and into Indiana in one. A considerable variation in runoff occurs within the state; it ranges from less than 8 inches in the west and northeast to more than 16 inches in the hill area of southern Illinois.

SEASONAL VARIATIONS IN THE HYDROLOGIC CYCLE

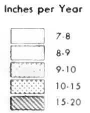
Precipitation continues in motion when it reaches the earth's surface. Its course depends upon the degree to which it is affected by the processes of infiltration, evaporation, transpiration, percolation, underground travel and detention, and surface flow. The influences and natural interrelationships of these processes vary with the seasons. Their effects may be studied best by beginning with the quantitative data available for rainfall and runoff and then from this base calculating the effects of the less well measured processes of evaporation and transpiration. The illustration opposite is the graphical result of such a procedure.

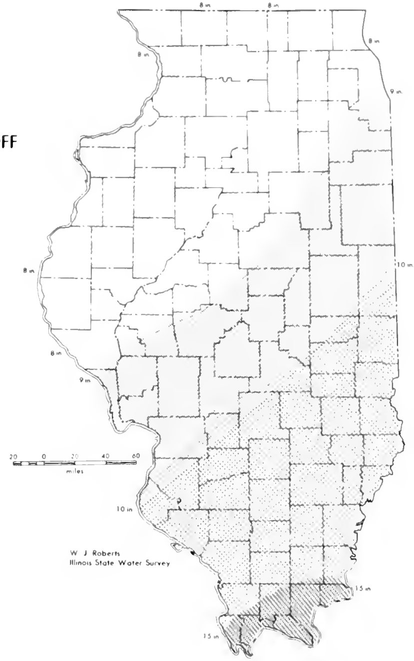
It demonstrates that water passes into storage during the spring and fall periods when the evaporation and transpiration rates are low. It shows how the rainfall deficiency of the warm months results in a lowering of ground water levels and a reduction in soil moisture. During drought years the recovery of ground water levels and the resumption of normal stream flow from such deficiencies may be seriously delayed.

MEAN ANNUAL RUNOFF

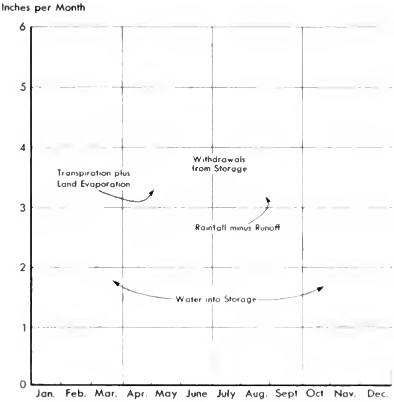
20 to 40-Year Records
for 25 Stations

Illinois State Water Survey





W. J. Roberts
Illinois State Water Survey



SEASONAL VARIATIONS IN THE HYDROLOGIC CYCLE

Southern Illinois

Illinois State Water Survey

W. J. Roberts
Illinois State Water Survey

MINIMUM RUNOFF

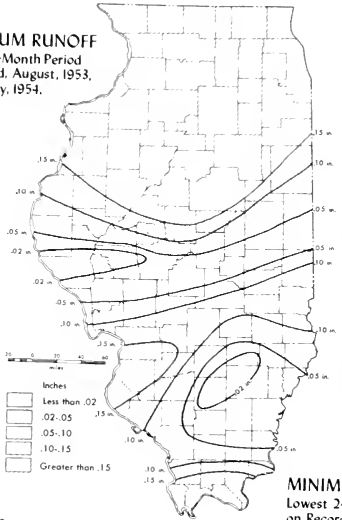
Minimum runoff is measured in terms of minimum stream flow, and is usually expressed in cubic feet per second at a specified location for the drainage area of the stream involved. Results may be stated in inches for comparison with rainfall data. The value in inches is determined by calculating the depth to which an area would be covered if the stream flow for a given period were uniformly distributed over its drainage basin. The minimum runoff record will reveal the least amount of water available during periods of low runoff and consequently will indicate the storage capacity necessary for water storage facilities to meet the demands during such periods of low runoff.

Observations from stream-gaging stations are of limited use for design purposes until they have been collected for at least 20 years. Data may then be tabulated by months, for instance, and totals for various periods calculated. The lowest value for the entire period of record can then be determined and plotted on a watershed map. In order to map minimum runoff, data are entered in the center of each drainage area. Isolines are so drawn that each runoff value represents the mean of its watershed area.

At the end of the 1952–1955 drought, a study applicable to central and southern Illinois revealed that this period had the lowest runoff of record. Maps were drawn of minimum runoff for periods of from six months to five years duration. They showed that runoff was less than 5 percent of normal for 20,000 square miles in southern Illinois during a one-year period and less than 25 percent of normal for approximately the same area during a two year period. Thus, many water supply reservoirs, already overtaxed by increased municipal and industrial demands, were virtually emptied by the balance of out-flow over in-flow during the drought years.

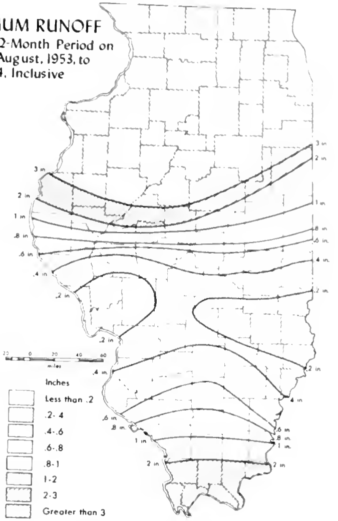
The designers of new water supply reservoirs require a knowledge of all watershed characteristics, including the size and shape of the drainage area, the soil types present, and slope relationships. A consideration of the values expressed by the minimum runoff map is also important in reaching proper design decisions.

MINIMUM RUNOFF
Lowest 6-Month Period on Record, August, 1953, to January, 1954, Inclusive

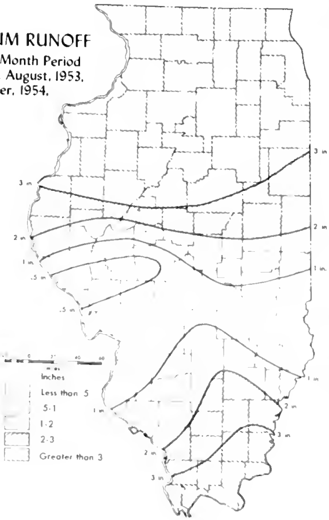


Illinois State Water Survey

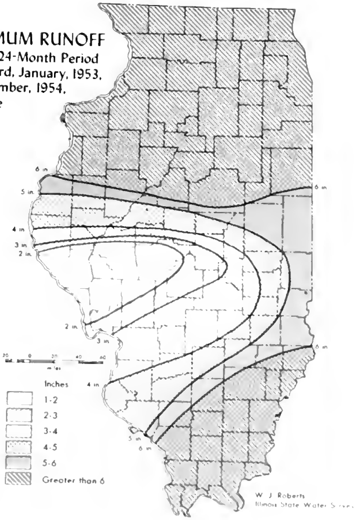
MINIMUM RUNOFF
Lowest 12-Month Period on Record, August, 1953, to July, 1954, Inclusive



MINIMUM RUNOFF
Lowest 18-Month Period on Record, August, 1953, to December, 1954, Inclusive



MINIMUM RUNOFF
Lowest 24-Month Period on Record, January, 1953, to December, 1954, Inclusive



DEVELOPED SURFACE WATER SUPPLIES AND POTENTIAL DEVELOPMENT

There are over 900 water bodies in Illinois which merit being classed as lakes or reservoirs; in addition there are thousands of farm ponds. They may be either natural or artificial, and range through lakes, impounding reservoirs, and sloughs. Natural lakes are associated with parts of the glaciated area in the very northern part of the state, particularly Lake County; these waters are used principally for recreation. Fortunately, ground water is available locally in amounts sufficient to meet the needs of municipal water systems and no cities or towns rely on surface water for their public supplies in this northern part of the state.

The greatest use of the state's surface water is from rivers—the Mississippi, the Wabash, the Ohio—with the addition of the considerable supplies obtained from Lake Michigan. Rivers within the confines of the state, such as the Rock, the Illinois, the Kaskaskia, the Embarrass, and the Big Muddy, also make sizeable contributions of water.

There are large reservoirs in central Illinois, such as Lake Springfield, Lake Bloomington, Lake Vermillion, and Lake Decatur, designed for surface water storage. These are primarily water supply reservoirs but they also provide opportunities for recreation. Population and industrial growth in the cities served by these facilities is increasing demands on the supplies to such an extent that the need for expanded storage capacities already is apparent. Centers such as Mattoon and Effingham, hard hit by the drought of the early 1950's, have already taken steps to improve their situations by building new reservoirs.

Nearly all the larger communities in the southern third of the state rely on impounding reservoirs for their municipal water supplies. Having outgrown their original facilities, many have built new reservoirs since World War II. Crab Orchard Lake, the state's largest impounding reservoir, covers 11 square miles and has a storage capacity of 67,320 acre-feet. Including other tributory reservoirs, completed or in the final stages of development, the total facility will eventually be able to provide for a continuous draft of approximately 50 million gallons a day.

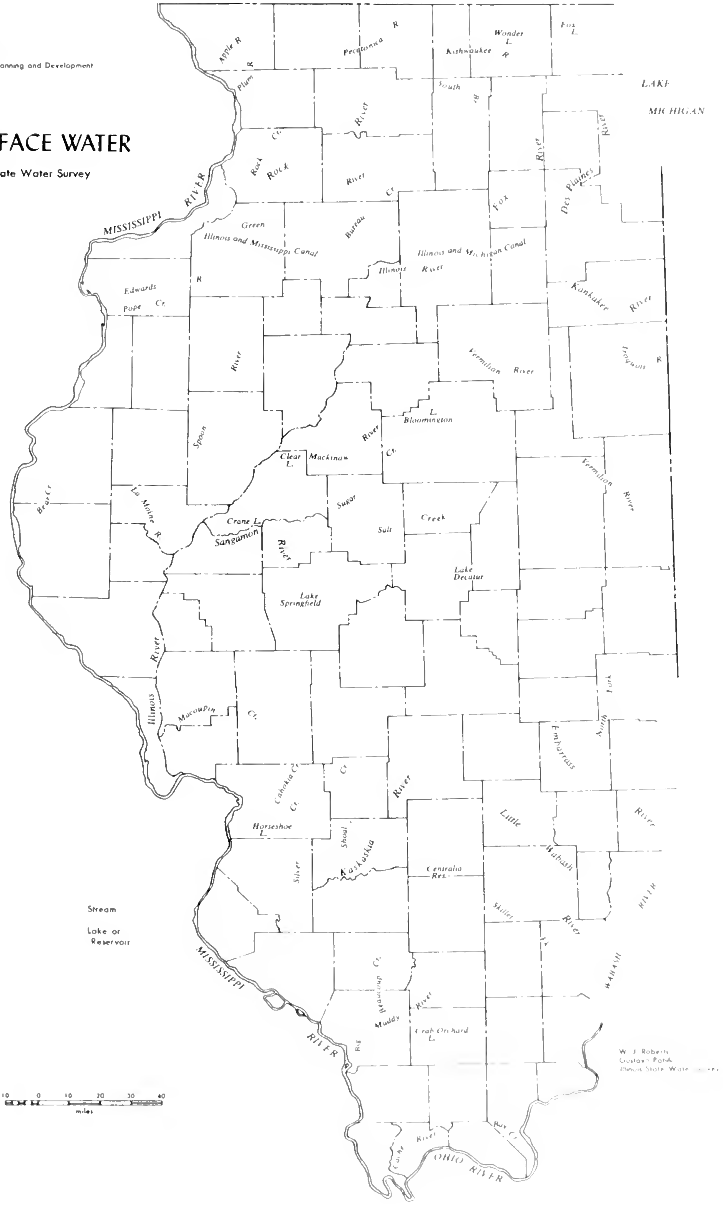
A recent study of the potential water resources of the 17 southern Illinois counties presents a favorable picture for the future. Hydrologic data indicate that reservoir sites are available for the potential development of a storage capacity able to supply 700 million gallons of water daily.

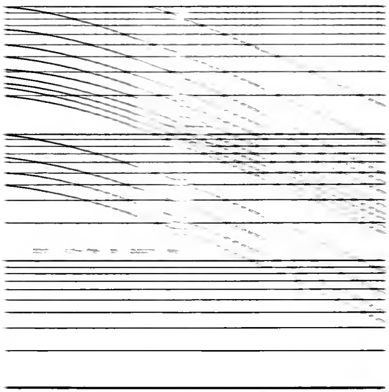
Surface waters are present in abundance in Illinois. There are many good sites awaiting development. Storage facilities for recreational, municipal, and industrial use are constantly in development and it can be said with assurance that the physical potential exists for a vast water resource development in this state.

Illinois
Industrial Planning and Development

SURFACE WATER

Illinois State Water Survey





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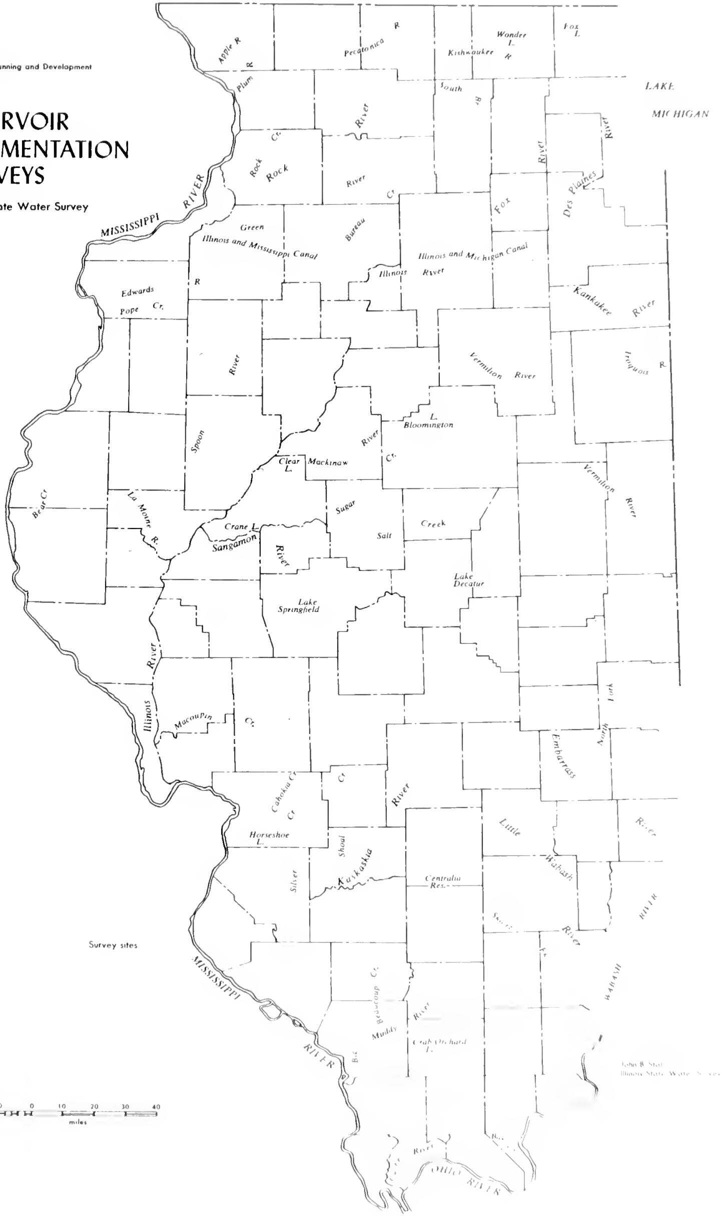
RESERVOIR SEDIMENTATION SURVEYS

Illinois State Water Survey



GROUND WATER GEOLOGY

Ground water in Illinois is usually obtained from deposits of sand and gravel in the glacial drift or from the limestone or sandstone formations of the underlying layered bedrock. In both cases, the occurrence of favorable supplies depends upon several factors, some relating to the source and physical character of the water itself and others to the requirements of the user.

The availability of ground water is controlled mainly by the presence of earth materials that store and transmit water. These materials, called aquifers, vary greatly in water-yielding capacity and are distributed in uneven fashion throughout the state. Other earth materials such as silt, clay, and shale may contain abundant water in the minute pores between grains but they retard movement of the water to such an extent that it cannot flow freely into a well.

Aquifers are replenished (recharged) by water that seeps directly into the ground from precipitation or from streams or lakes. The rate of recharge of an aquifer often determines whether ground water withdrawal can be maintained safely for a long period of time.

The mineral and bacterial quality of the water itself affects the availability of favorable supplies. In general, ground water is more highly mineralized at greater depths. The result is that some aquifers yield potable water only where they are close to the land surface.

In addition to natural factors, the requirements of the user affect the suitability of an area for ground water development. For example, where large supplies are required, as for an industry, or where water of specific chemical quality or temperature is needed, only certain areas of the state may be considered favorable.

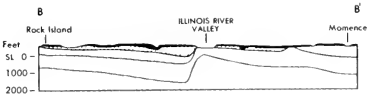
The map on the facing page shows the distribution and water-yielding characteristics of the various bedrock formations below the glacial drift; the cross sections illustrate the vertical arrangement of the formations, including the glacial drift.

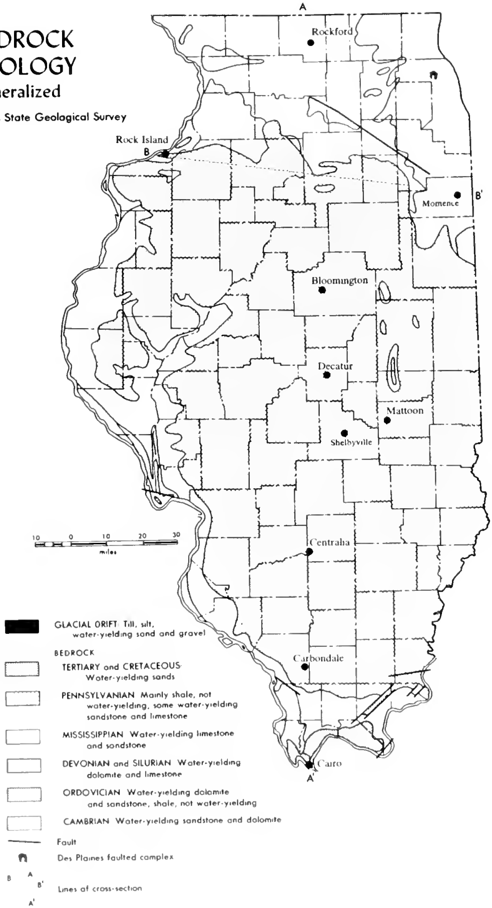
Bedrock formations (Cambrian through Devonian) are favorable aquifers in the northern third of Illinois where potable supplies are obtained to depths of 1500 feet or more. However, these formations dip southward to a much greater depth in south-central Illinois, where a troughlike structure, the Illinois Basin, is developed (cross section AA′). Here they contain salt water.

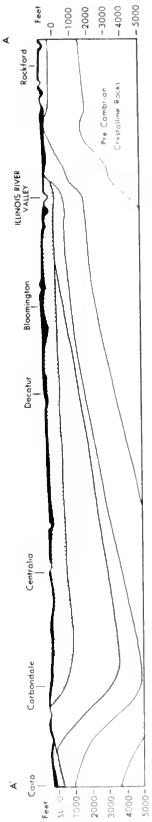
The Mississippian, Devonian, and Silurian limestones, which are aquifers of small yield west of the Illinois River and at the southern tip of the state, also dip toward the Illinois Basin. Here they are overlain by Pennsylvanian rocks—mainly shale—in which only small scattered supplies of ground water are available. Most of the area covered by Pennsylvanian rocks is relatively unfavorable for obtaining ground water from the bedrock.

BEDROCK GEOLOGY
Generalized

Illinois State Geological Survey







SAND AND GRAVEL AQUIFERS

Most of Illinois is mantled by unconsolidated deposits left by the glaciers that overrode the north-central United States during the "Ice Age." The greatest southern penetration of the ice in Illinois was about to Carbondale. The last great glacial advance in the state reached as far south as Shelbyville and Mattoon and as far west as the Mississippi River north of Rock Island.

Glacial ice sheets, moving outward from centers of snow accumulation in Canada, scraped up soil and rock debris, transported it southward, and eventually dropped it along the melting ice borders. Deposits related to glacial times are mainly of three types, as they exist today: till, outwash, and loess. Till is a mixture of unsorted, silty, sandy, pebbly clay deposited directly from the ice. Sands, gravels, and silts spread by the meltwaters are termed outwash. Loess occurs on uplands as deposits of wind-blown silt from the river flats.

Outwash sands and gravels are one of the main sources of ground water in Illinois. Outwash was deposited mainly in valleys leading away from the ice fronts. Thus the valley systems that were in existence before and during glaciation are today excellent water-producing areas. In these sand and gravel-filled areas large quantities of water are available from relatively shallow wells that are usually drilled to less than 300 feet. Some of the valley systems are occupied by streams today, among them the valleys of the Mississippi River, the Wabash River, the lower two-thirds of the Illinois River, and the Kaskaskia River. In these instances coarse deposits of outwash occur beneath recent river alluvium.

Other valleys were completely buried or obliterated by glacial deposits and are known today only from drilling records. The Mahomet Valley of east-central Illinois is one of the most important and best known. The thick sand and gravel beds in this buried valley provide ground water for many municipal and industrial supplies.

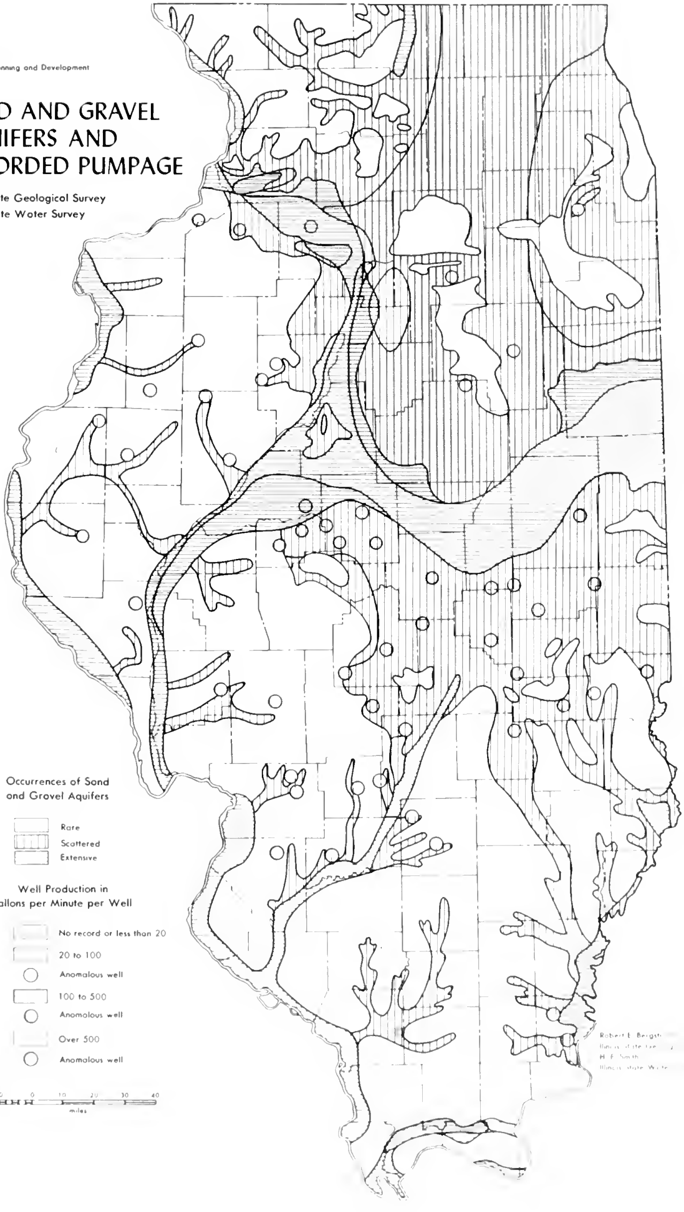
The upland areas between the valleys were not flooded with meltwater carrying outwash. Sand and gravel deposits are therefore less extensive and ground water conditions are accordingly less favorable.

Because northeastern Illinois was covered by glaciers during several stages of the "Ice Age," the deposits here are thicker and more varied than in southern and western parts of the state where only the earlier glacial deposits are present. In most of the northeast, moderate quantities of ground water can be secured from sand and gravel aquifers in the glacial drift. In the western and southern parts of the state, where the drift is thin and composed mainly of till and loess, little water can be secured from the drift except in the flood plains of the major streams.

Illinois
Industrial Planning and Development

SAND AND GRAVEL AQUIFERS AND RECORDED PUMPAGE

Illinois State Geological Survey
Illinois State Water Survey



LIMESTONE AQUIFERS

Wells in limestone and dolomite, the latter a limestonelike rock rich in magnesium, draw water mainly from openings in the rock—joints, fissure systems produced by earth stresses, and channels opened and enlarged by water solution. These rocks are commonly too dense to yield much water from pore spaces as do sandstone and other granular deposits. Because the water-filled fissure systems are irregular in size and distribution, yields from closely spaced, similarly constructed wells in limestone and dolomite may be quite different.

Particular attention to sanitary conditions is necessary in planning wells in a limestone or dolomite area. When either is the uppermost bedrock formation, whether exposed at the surface or overlain by thin glacial drift, there is danger of bacterial pollution entering the ground water reservoir. Quarries may be sources of such contamination. The openings provide little filtering or other purifying action, and polluted water may travel long distances.

The Silurian dolomite, commonly called Silurian limestone, is a source of ground water in northeastern and northwestern Illinois as shown on the facing map. Many municipal and most domestic wells in Du Page County and southern Cook County are drilled into these rocks. These wells are usually less than 500 feet deep and yield from a few gallons to over 1000 gallons per minute.

Ordovician dolomites and limestones, specifically the Galena-Platteville beds, are widely used as a water source in that part of northern Illinois where they occur directly below the glacial drift. Under these conditions they provide dependable, although only small-to-moderate, supplies. However, where they are overlain by the uppermost Ordovician shale formation (Maquoketa) they are usually poorly fissured and yield little ground water.

Mississippian limestones (St. Louis and Keokuk-Burlington) are a source of ground water chiefly west of the Illinois River. Usually the yields are not more than 10 to 20 gallons per minute. Wells in these formations are used mainly for domestic supplies. South and east of the Illinois River, water-yielding limestones containing potable water are generally absent, except in two small areas. In Douglas and Champaign Counties water-yielding Devonian and Silurian limestones occur below the glacial drift along the crest of a north-south arch in the bedrock. At the southern tip of the state, limestone wells are constructed in Mississippian, Devonian, and Silurian limestones along the south rim of the Illinois Basin. These wells range in capacity from less than 20 gallons to over 500 gallons per minute.

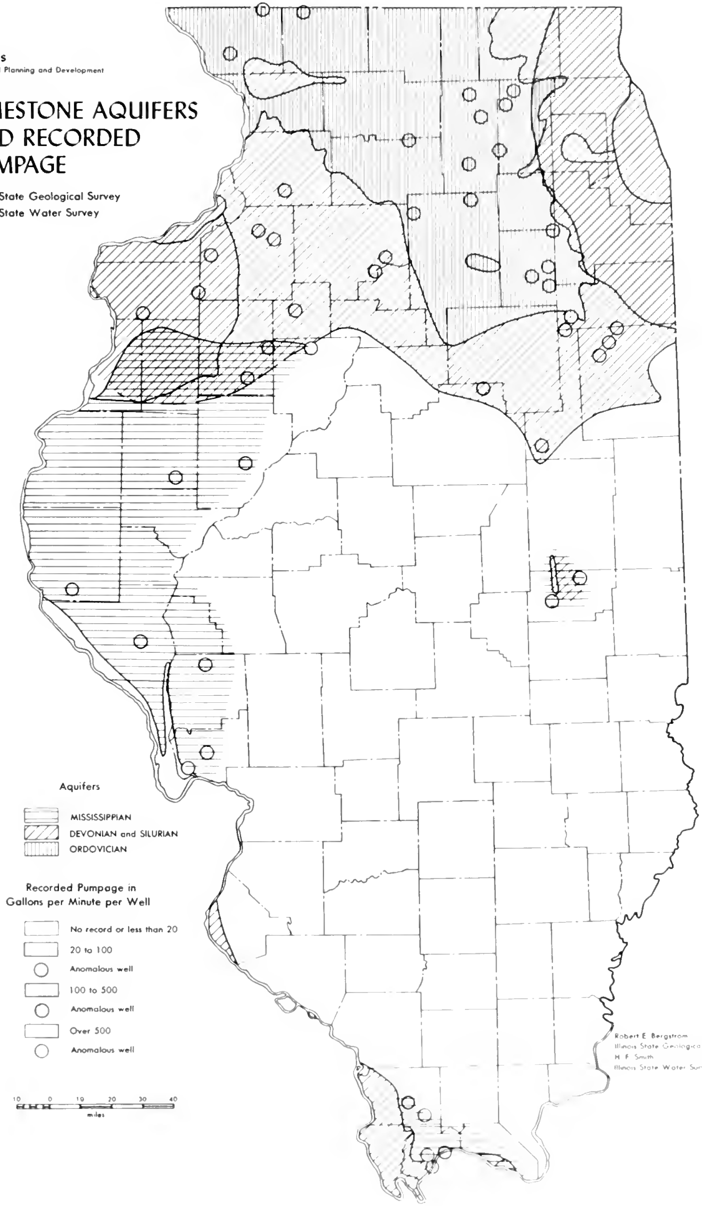
Illinois

Industrial Planning and Development

LIMESTONE AQUIFERS AND RECORDED PUMPAGE

Illinois State Geological Survey

Illinois State Water Survey



Robert E. Bergstrom

Illinois State Geological Survey

H. F. Smith

Illinois State Water Survey

SANDSTONE AQUIFERS

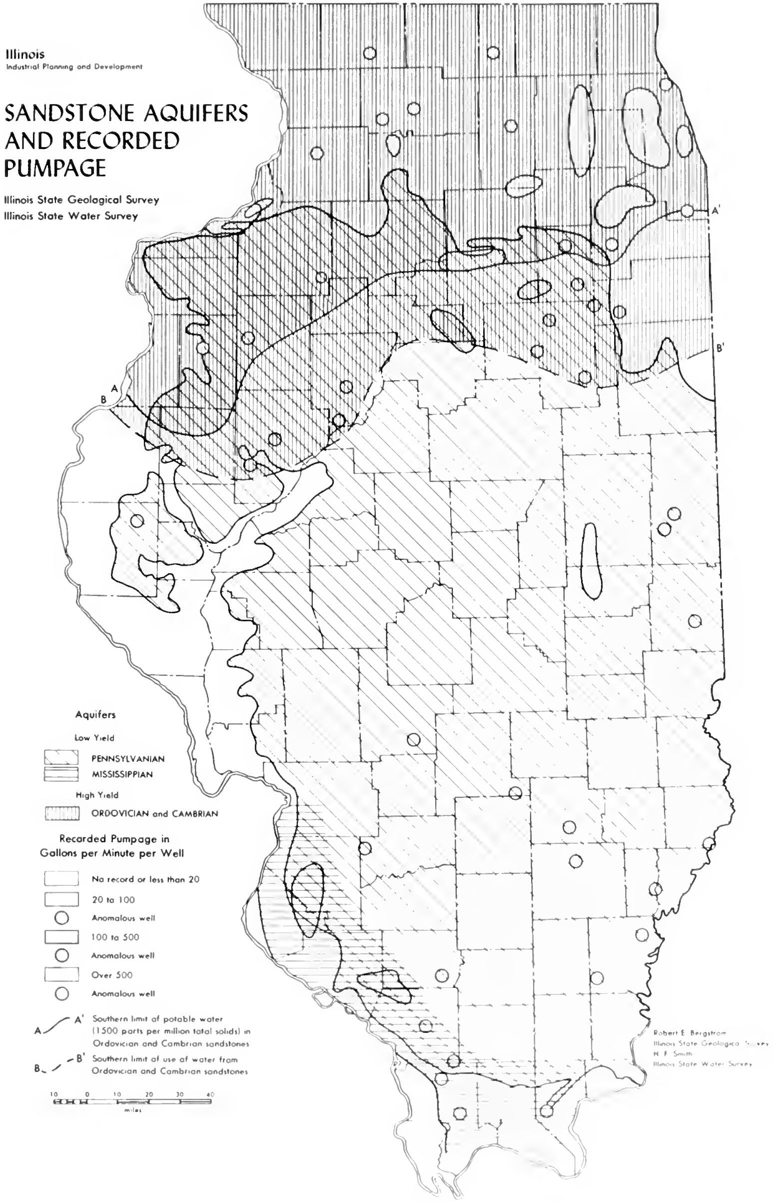
Ground water is obtained from sandstone in many parts of Illinois. The most favorable area is the northern fourth of the state, where large supplies are available from the thick, extensive Galesville and Mt. Simon sandstones of Cambrian age and the St. Peter sandstone of Ordovician age.

The Cambrian and Ordovician sandstone aquifers, which are separated by about 400 feet of less permeable beds, are near the surface in south-central Wisconsin and north-central Illinois. From these localities they dip southeastward and wells may be drilled to 2000 feet in tapping these rocks in the vicinity of Chicago. The Galesville sandstone is the most consistently permeable of the three aquifers and supplies water for high-capacity wells producing 300 to 1500 gallons per minute.

The Cambrian and Ordovician sandstone aquifers are under artesian pressure—that is, water rises in a well above the top of the producing aquifer. Artesian conditions are a result of the aquifers being overlain by "tighter" beds which hold the water under pressure maintained by the head developed at the higher intake areas to the west and north. Many of the early wells drilled into the sandstones flowed at the surface; however, the artesian pressures receded as more and more high capacity wells were drilled. Today, water levels are over 500 feet below ground surface in a few places in northeastern Illinois.

The water from the sandstones is highly mineralized east of the Des Plaines River and south of the Illinois River. The line A-A′ on the map is approximately the southern limit of potable water (less than 1500 parts per million total dissolved solids) in these sandstones. For lack of more suitable water supplies, wells are drilled locally to the sandstones a short distance south of this line (to B-B′).

In the central and southern parts of the state thin sandstone beds in the Pennsylvanian system yield small quantities of water, seldom more than 10 gallons per minute. Also, there are a few areas where Mississippian sandstones yield ground water along the southwestern border of the state. Wells in these sandstones have low capacities, rarely exceeding 20 gallons per minute.


Illinois
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SANDSTONE AQUIFERS AND RECORDED PUMPAGE
Illinois State Geological Survey
Illinois State Water Survey
A
B
A'
B'
Aquifers
Low Yield
PENNSYLVANIAN
MISSISSIPPIAN
High Yield
ORDOVICIAN and CAMBRIAN
Recorded Pumpage in Gallons per Minute per Well
No record or less than 20
20 to 100
Anomalous well
100 to 500
Anomalous well
Over 500
Anomalous well
Southern limit of potable water (1500 parts per million total solids) in Ordovician and Cambrian sandstones
Southern limit of use of water from Ordovician and Cambrian sandstones
10 0 10 20 30 40
miles
Robert E. Bergstrom
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Illinois State Water Survey

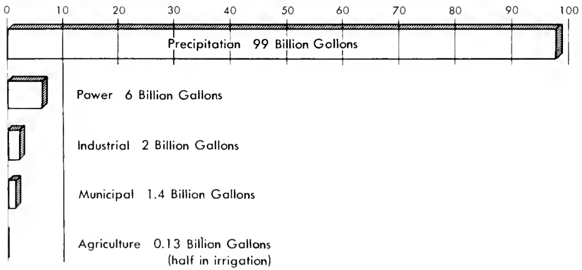
INDUSTRIAL WATER PUMPAGE

Industrial pumpage refers to water pumped by industry from private sources. There is some industrial pumpage in nearly every county in Illinois. However, 10 industrial centers—Chicago, Joliet, the Fox Valley, La Salle, Rockford, Sterling, Rock Island, Peoria, Decatur, and East St. Louis—dominate the situation from the standpoint of volume. There are a few smaller areas where pumpage amounts to between 5 and 10 million gallons per day. Individual industries scattered within the state account for 90 million gallons of daily production.

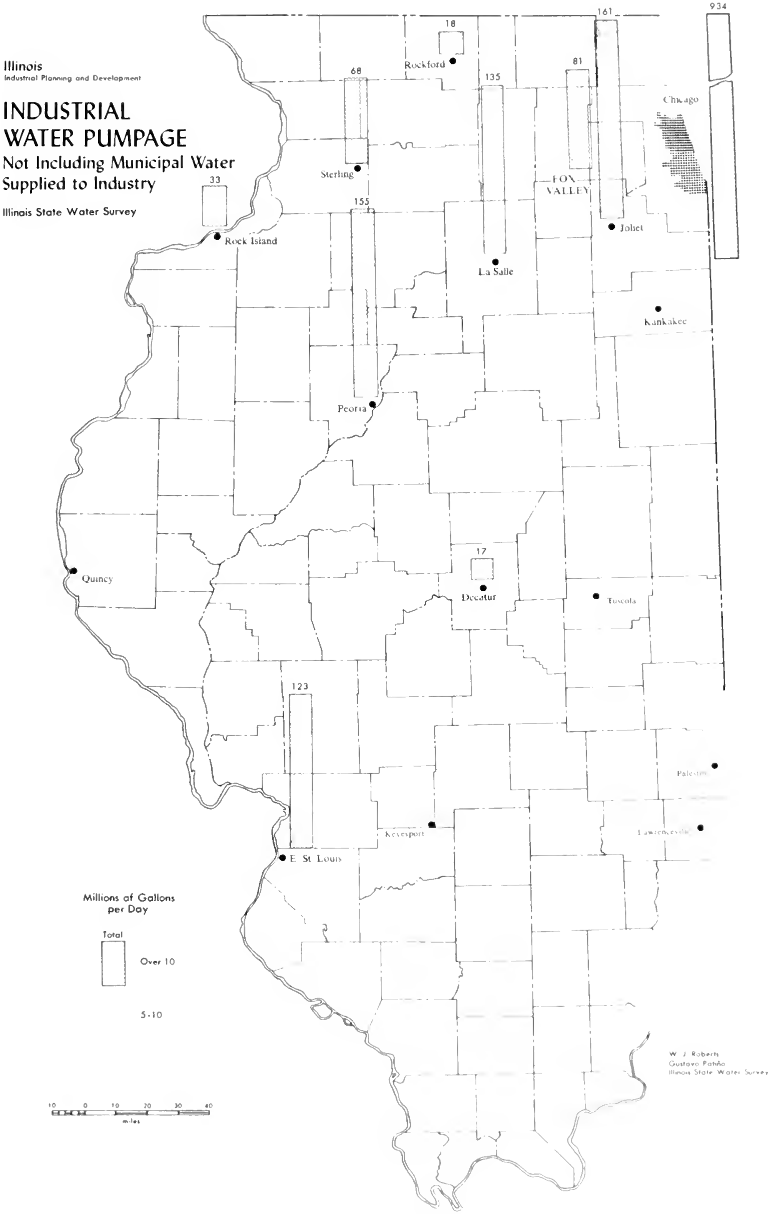
A total of approximately 1700 million gallons per day is pumped by 489 establishments, either from their own wells or from private surface water sources. Of this total over 250 million gallons per day are pumped by 394 industries from ground water, while 95 establishments pump over 1450 million gallons of surface water daily.

In addition to the private pumpage, industry buys approximately 350 million gallons of water per day from municipalities. If water used by hydroelectric generating plants and steam generating electric plants is included, industry in Illinois requires more than eight billion gallons in day-to-day operations.

Large as this total seems, it is very small compared to the amount of water available from the streams, rivers, and ground water supplies of Illinois. The quantities of water needed for an increasing population and for industrial growth and expansion are present in amounts sufficient to meet all foreseeable future needs.



AVERAGE DAILY PRECIPITATION AND PUMPAGE


Illinois
Industrial Planning and Development
INDUSTRIAL
WATER PUMPAGE
Not Including Municipal Water
Supplied to Industry
Illinois State Water Survey
18
Rockford
68
135
81
161
934
Chicago
Sterling
FOX
VALLEY
33
155
Rock Island
Joliet
La Salle
Kankakee
Peoria
17
Quincy
Decatur
Tuscola
123
Keyesport
E St Louis
Millions of Gallons
per Day
Total
Over 10
5-10
10 0 10 20 30 40
miles
W. J. Roberts
Gustavo Patiño
Illinois State Water Survey

IRRIGATION

Supplemental irrigation has been practiced in Illinois for about 30 years. From a few systems operated in Kankakee County in 1925, the practice has spread to 76 Illinois counties where in 1957 an estimated 338 separate systems could water approximately 16,500 acres. The accompanying distribution map of irrigation systems in Illinois shows the greatest concentration in Kankakee County. Here over 50 gladiola growers supplement rainfall with sprinkler systems that use water from wells. There are also isolated systems depending on wells in several other counties, including Cook, Lake, and Woodford. Many developments are located in the alluvial plains of the principal rivers; others make use of ponds, lakes, and streams. In Madison County 18 wells have been put into operation in recent years to supply additional moisture for the high-value horse-radish crops.

Adequate water supply is the principal locational factor in irrigation. Topography, soil type, crop to be grown, and the availability of labor are also important considerations. Many irrigation systems have been purchased for use in Illinois without thought for the large amount of water necessary for efficient operation. With the advent of light, portable pipe about 1950, many farmers invested heavily only to find that their water sources were dry at times of critical need. In recent years nearly all irrigation systems have been purchased only after thorough studies of water availability. In Illinois, the State Water Survey and the State Geological Survey have data available on the quality and quantity of surface water and ground water for any part of the state. The University of Illinois College of Agriculture has prepared sprinkler system guides for surface irrigation. The Department of Agricultural Engineering at the University has several circulars on irrigation available for distribution and also conducts irrigation clinics for salesmen, engineers, and interested farmers.

At present, the greatest returns from investment appear to be from growing high income crops. Normally the rainfall during the growing season plus water stored in the soil is adequate for soybeans and corn. Thus a considerable increase in crop output would be necessary to justify an investment in irrigation equipment for the major field crops.

Present Illinois laws do not define the rights of land owners regarding use of water for irrigation. Local shortages and the ensuing competition for water have created difficulties in some cases. The prospective user of irrigation equipment in Illinois should, therefore, assess the availability of water sufficient for his purpose, the cost of supply, and the competitive aspects of the situation before selection of any specific location.

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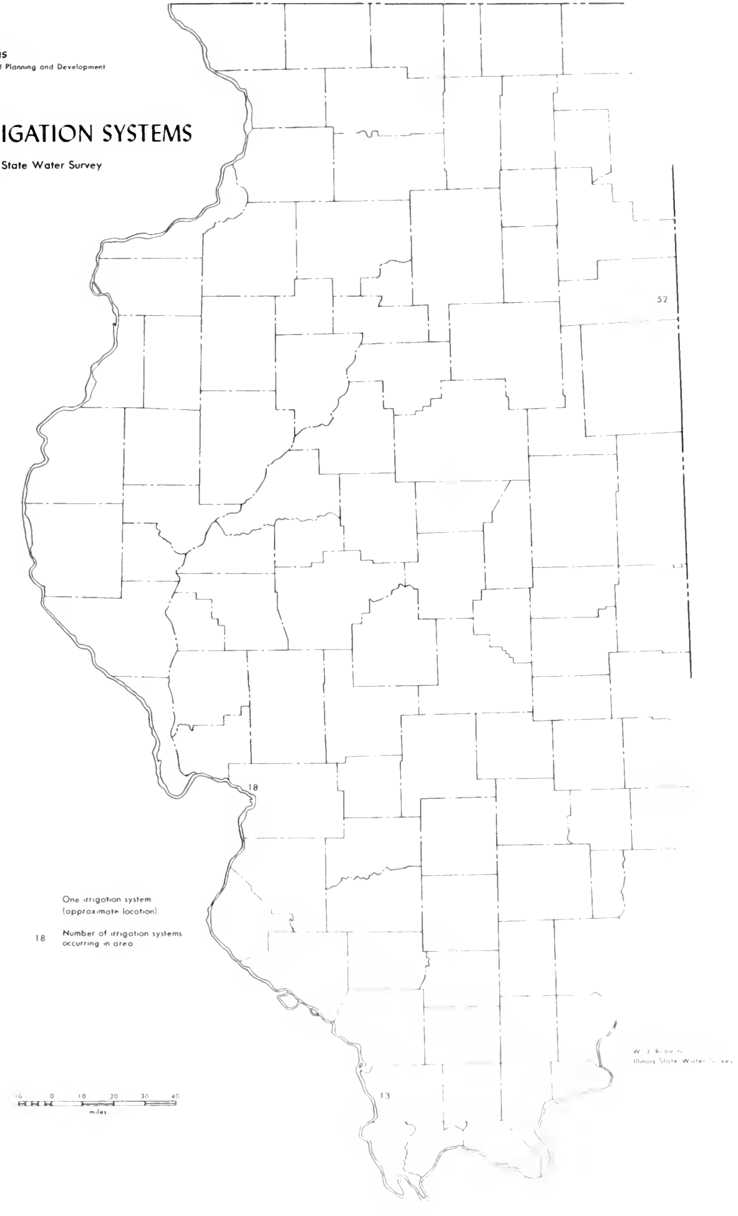
IRRIGATION SYSTEMS

Illinois State Water Survey



MINERAL QUALITY OF ILLINOIS WATERS

In the natural course of events, water is virtually an indestructible chemical compound. Although it exists in many forms and places, its availability in the free state—as atmospheric, surface, or ground water—is the primary concern of man. Beyond the universal necessity of water for survival, man's interests are directed toward having the right quality in the right amount at the right time. One aspect of fundamental interest, especially in our industrialized world, is the chemical content of water. Any discussion of this subject revolves around surface and ground water supplies, as the amounts of chemicals in atmospheric moisture are so small they are seldom significant.

Water comes close to being the universal solvent; certainly this is the case in its natural role. In its movement over and within the earth's surface, water dissolves or otherwise collects mineral and organic substances. The nature of this burden varies with time and place, and there is, from man's standpoint, no combination of substances that will suit every use. For today's mechanized society, the presence of dissolved or suspended substances may affect the utility of water. In the past, industries often were located with respect to water of suitable quality. The great demands placed upon the resource largely preclude this possibility today, but methods now available can be used to modify or remove the dissolved and suspended components in water to the extent that any water can be made suitable for almost any purpose. Costs, however, may exceed the economic benefit, so the public and industry alike are alert to this problem as new sources of water are developed and old sources expanded.

Water in Illinois is usually mineralized to a degree, is hard, and may also contain either some form of iron or suspended matter. The qualities of the available supplies are such, however, that these substances can be successfully and economically removed if they prove undesirable. Surface and well waters of the state are similar in hardness and other mineral content. There are, naturally, significant exceptions. All public water supplies obtained from streams, lakes, and reservoirs are clarified and chlorinated as a basic treatment, supplemented with treatment for taste and odor control, and are frequently softened.

In general, streams in the northern part of the state have an average dissolved mineral content of about 450 parts per million (ppm) and a hardness of about 400 ppm. Values decrease to near 300 ppm mineral content and 250 ppm hardness in western and southern Illinois. The waters from Crab Orchard Lake in the extreme south are exceptionally low in mineral content and hardness, running 200 ppm and 110 ppm respectively.

Fifty-four of 288 municipalities of over 2000 population, drawing water from streams and wells, have installed water softening plants. In addition, the public

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MUNICIPAL WATER SOFTENING PLANTS

Illinois State Water Survey

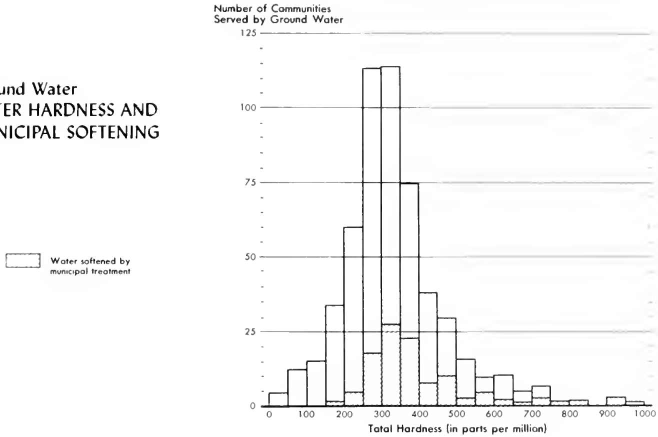
water supplies of 80 smaller communities receive softening treatment. Lake Michigan water, which supplies 57 communities in addition to Chicago, is noted separately, as its mineral content is uniformly at 150 ppm and its hardness 125 ppm. Large scale softening is not indicated.

In Illinois, approximately 35 percent of the public ground water supplies have less than 0.4 ppm iron concentration, which is not sufficient to cause staining. In addition, 27 percent of the systems containing more than this amount have iron removal plants. All clarified surface water supplies are free of iron. Manganese is present in sufficient quantities to stain in about 5 percent of the public ground water supplies, and about one-half of these communities remove it by treatment.

Stream temperatures, as a general rule, vary from 32° to 75° or 85° F. between winter and summer. Ground water on the other hand, shows no great temperature variations and those that occur are gradual changes associated with depth beneath the surface of the earth. Water from depths less than 300 feet in the northern part of the state varies from 48° to 54° F. With greater depths this value often increases and may rise as high as 62° or 64° F. at between 1600 and 2000 feet. In the south, water from depths of less than 300 feet may be between 55° and 60° F. West of the Illinois River and south of Rock Island, deep well waters from 1400 to 2400 feet may have temperatures as high as 72° to 76° F.

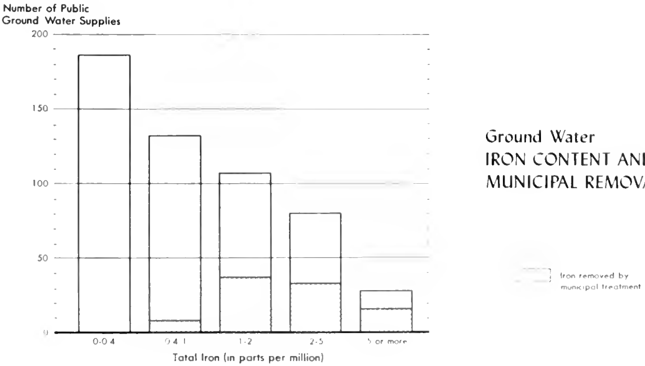
Water is abundant in Illinois today, and is sufficient to serve a growing population and an expanding industry. It is also very important to know that these supplies are suited chemically and temperaturewise for most public and private uses. When this is not the case the qualities are such that water treatment is economically feasible. Perhaps a greater problem concerning our water supply is contamination by man. The waste materials he may add to water can be much more difficult to remove than nature's mineral and organic substances.

Ground Water
WATER HARDNESS AND MUNICIPAL SOFTENING



Illinois State Water Survey

T. E. Larson
Illinois State Water Survey



Ground Water
IRON CONTENT AND MUNICIPAL REMOVAL

AVERAGE ANNUAL AND MONTHLY PRECIPITATION

Precipitation in Illinois varies considerably in time and space. The annual average amount is lowest in northeastern Illinois near Lake Michigan, where it is less than 32 inches. The highest average annual precipitation, more than 46 inches, occurs in the hill region of southern Illinois. The precipitation which produces this annual excess of south over north occurs during the colder half-year (October through March). For the warmer half-year (April through September), the average precipitation varies only from 20 inches in the north to 24 inches in the south, while during the six colder months the precipitation varies from 12 inches in northern Illinois to 23 inches in southern Illinois.

Precipitation in Illinois is associated principally with the interaction of different air masses within the state. The nature of the continental type of climate allows frequent penetrations throughout the year of different types of air masses and their associated weather disturbances. These often produce rain or snow. The basic difference between winter and summer precipitation is related to the character of the air masses. Relatively cold, dry air masses predominate in the winter, especially in the north, while relatively warm, moist air masses predominate in the summer. During the warmer months, the climate throughout the state is much the same. This similarity in basic warm season conditions is in part expressed by the lack of a real variability in the average precipitation of the warmer half-year. Fifty-four percent of the annual precipitation in southern Illinois occurs during the crop-growing season, 61 percent occurs during this period in central Illinois, and 64 percent in northern Illinois.

During the colder half-year a striking north-south difference in climate exists. Although the southern Illinois winter is much colder than the summer, the temperatures are warm enough and the air sufficiently moist to produce thunderstorms and summer-type characteristics in the winter precipitation. However, in central and northern Illinois the predominating cold, dry continental air does not permit the development of heavy precipitation.

The average annual number of days with measurable precipitation increases from west to east across the state from an average of 110 days per year in the west to an average of 120 days in the east. However, the average annual number of days with 0.25 of an inch or more increases from 38 in northern Illinois to 50 in the south. February is the month of lowest average monthly precipitation throughout most of the state. There is, however, a latitudinal distribution from south to north in the average maximum monthly rainfall. March and April are peak months in southern Illinois. May predominates in central Illinois and June has the highest average in the north.

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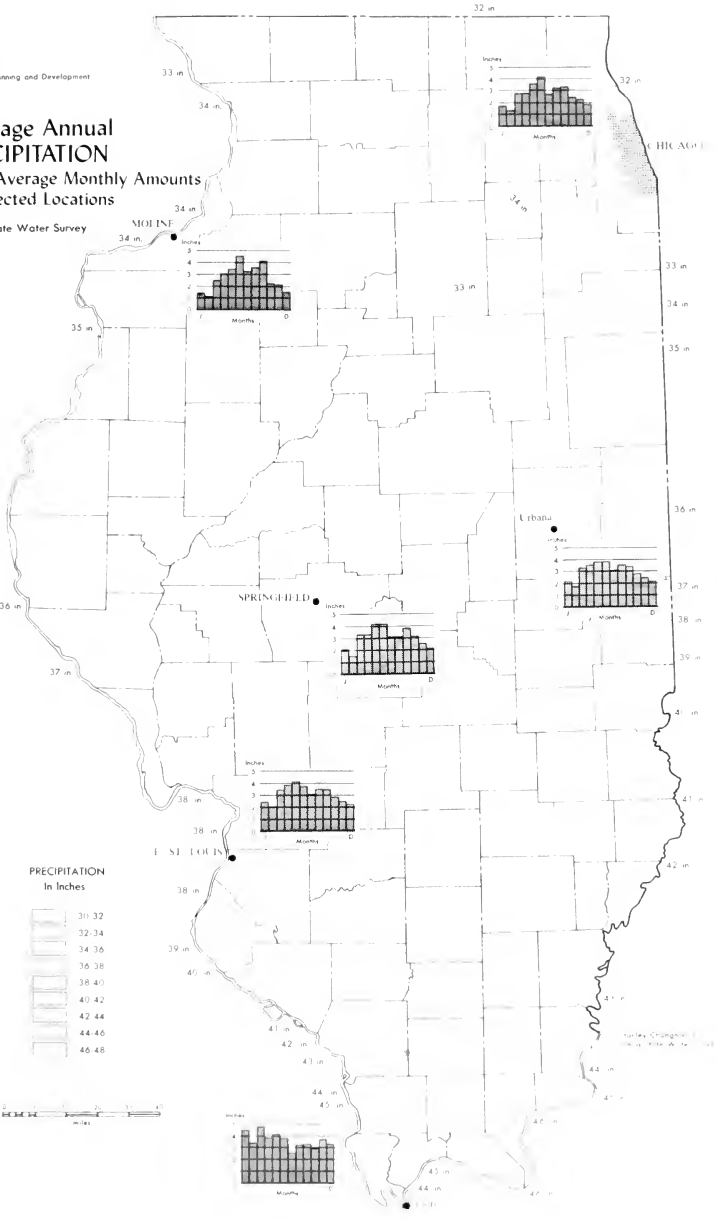
Average Annual PRECIPITATION
With Average Monthly Amounts at Selected Locations

Illinois State Water Survey



FREQUENCY OF ANNUAL MAXIMUM AND MINIMUM PRECIPITATION

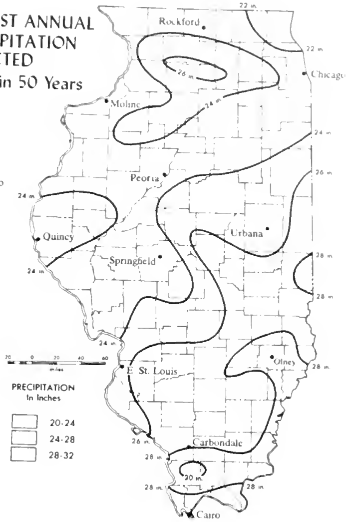
Due to the great variability in annual precipitation from year to year, the annual averages are not representative of the conditions that can be expected to occur in any particular year. To express this variability, the occurrence of the annual maximum and minimum precipitation amounts expected on an average of once in 5 and once in 50 years are shown on the accompanying maps. For example, the annual minimum precipitation may be 22 inches or lower once in 50 years in northeastern Illinois; in the same period, a single year low of 28 to 30 inches can be expected in southern Illinois. Likewise, the highest annual precipitation expected once in 50 years in southern Illinois is 74 or more inches, while the probable maximum is 44 inches or more in the extreme northeastern part of Illinois for the same span of time.

Since 1950, "once in 50 years" extremes of precipitation have occurred in Illinois. For instance, in 1957 Cairo received 72.98 inches, which was the wettest year in 86 years of record, and this was the second total since 1900 to exceed the 69.21 inches expected to be equalled or exceeded once in 50 years, on the average, at this station. Similarly, Paris, with 63.90 inches in 1957, exceeded the "once in 50 years" expected amount of 51.28 inches for the first time in 57 years of record.

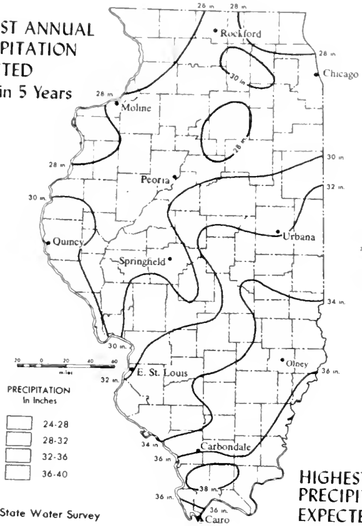
Recent years have also provided precipitation totals that equaled or exceeded "once in 50 years" extremes of minimum precipitation. During the 1952–1955 drought in the southern half of Illinois several locations experienced extremely dry years. For instance, Mount Vernon had 27.50 inches in 1953. This was the second year since 1901 with a total below 27.64 inches, the "once in 50 years" expected low at the station.

Prolonged drought periods lasting one year or longer occur infrequently in Illinois and seldom affect the entire state. Furthermore, most droughts or rainfall deficiency periods which may occur can not seriously affect surface water supply sources if proper reservoir design is employed.

LOWEST ANNUAL PRECIPITATION EXPECTED Once in 50 Years

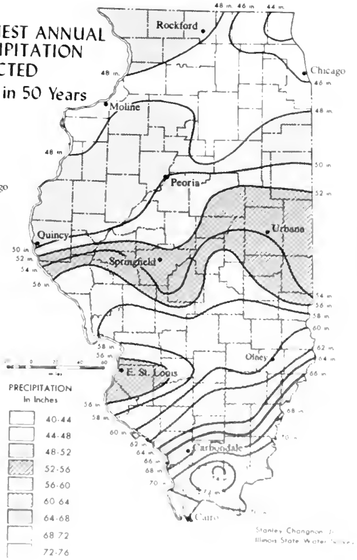


LOWEST ANNUAL PRECIPITATION EXPECTED Once in 5 Years

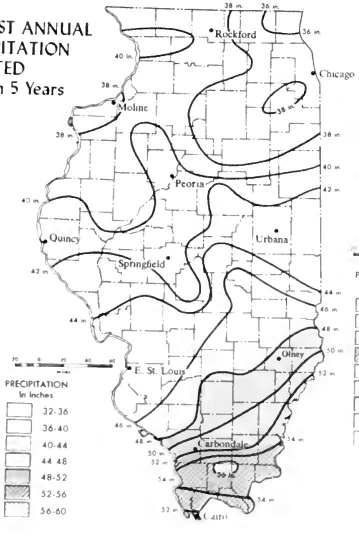


Illinois State Water Survey

HIGHEST ANNUAL PRECIPITATION EXPECTED Once in 50 Years



HIGHEST ANNUAL PRECIPITATION EXPECTED Once in 5 Years



Stanley Changnon Jr.
Illinois State Water Survey

LONG-PERIOD PRECIPITATION

In the selection of weather stations to portray long-period precipitation in Illinois, the length of the available record, the continuity of the record, and the degree to which these represent various parts of the state were of primary concern. Cairo and Chicago would seem to raise no questions in meeting the above qualities. There is no station in Illinois which has precipitation records approaching the length and continuity of those from St. Louis, Missouri. This station can well represent the southwestern part of the state. Peoria has the only long and continuous record for the area north and west of Springfield.

Neither for Illinois as a whole nor for any individual station is there a definite precipitation cycle over a period of years. Periods of varying length with relatively low, as well as relatively high, precipitation exist, but there is no periodicity. From 1872—the year for which all four stations first reported—through 1957 there have been 18 years when all stations had precipitation above the average. Only on one occasion did all four have precipitation above the average for as many as three consecutive years: 1882, 1883, and 1884. Only on three other occasions did all stations have precipitation above the average for even two consecutive years.

During 19 different years all stations had precipitation below the average, but only on one occasion was it below for as many as three consecutive years: 1899, 1900, and 1901. In 1955 and 1956 the precipitation was below average at all stations for the only other occasion with as many as two consecutive years. Cairo and Peoria have each had five consecutive years with precipitation above the average, while Chicago and St. Louis have each had six. Chicago's precipitation has been below average for no more than three consecutive years, Peoria for four, St. Louis for five, and Cairo for seven. For the four stations as a whole 1930 was driest, though this was not the driest year for any one of them, and 1957 the wettest, but actually the wettest only for Cairo.

If there has been any permanent change in the amount of precipitation over the years, these four stations do not reveal it. If the record for each station is divided into quarters, certain facts appear. At Cairo the driest quarter of the record averages 38.71 inches, the wettest 45.89 inches, while at Peoria the driest quarter averages 34.84 inches and the wettest 34.96 inches, for the greatest and least departures. The percentage departure from normal for the driest and wettest year has been 63 and 173 at Cairo, 60 and 180 at St. Louis, 66 and 153 at Peoria, and 67 and 139 at Chicago. The variation from year to year and the absence of any pattern for the state as a whole, or for individual stations, makes long-period forecasting on the basis of trends impossible as of now. However, if past records in any way reflect the future, it may be assumed that precipitation will continue to supply Illinois with water equal to the amount of the past.

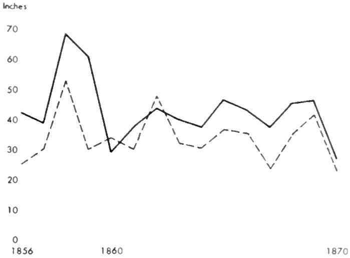
Illinois
Industrial Planning and Development

Long-Period Record of ANNUAL PRECIPITATION St. Louis, Peoria, Chicago, and Cairo

U. S. Weather Bureau

John L. Page
Department of Geography
University of Illinois

	Average
——— St Louis	38.22 in.
- - - - Peoria	34 90 in.
Chicago	33.01 in.
Cairo	42.47 in.



SNOWFALL

The distribution of snowfall in Illinois is directly related to the normal north-south differences in the winter temperatures. Under conditions which bring on precipitation during the colder half-year, moisture which falls as snow in northern Illinois usually falls as rain in the southern part of the state. Northwestern Illinois is the area of maximum snowfall, receiving over 36 inches annually. This is nearly four times more than that normally falling in the extreme south. The location of this area of greatest snowfall is associated with cold, polar continental air which normally predominates northwest of Illinois during the winter season. Moderating temperatures related to differences in latitude are responsible for the decreasing average annual snowfall as one progresses southward. Local conditions and influences, of course, give rise to some irregularities in this pattern.

January is the month of highest average snowfall in the north and in a small area in the extreme south. However, February is the peak month for the area bounded on the north by a line from Alton to Danville and on the south by an east-west line crossing the state not far north of Cairo. Northern Illinois stations show measurable amounts of snow for seven months of the year on the average, as compared to only four months on the average in the south.

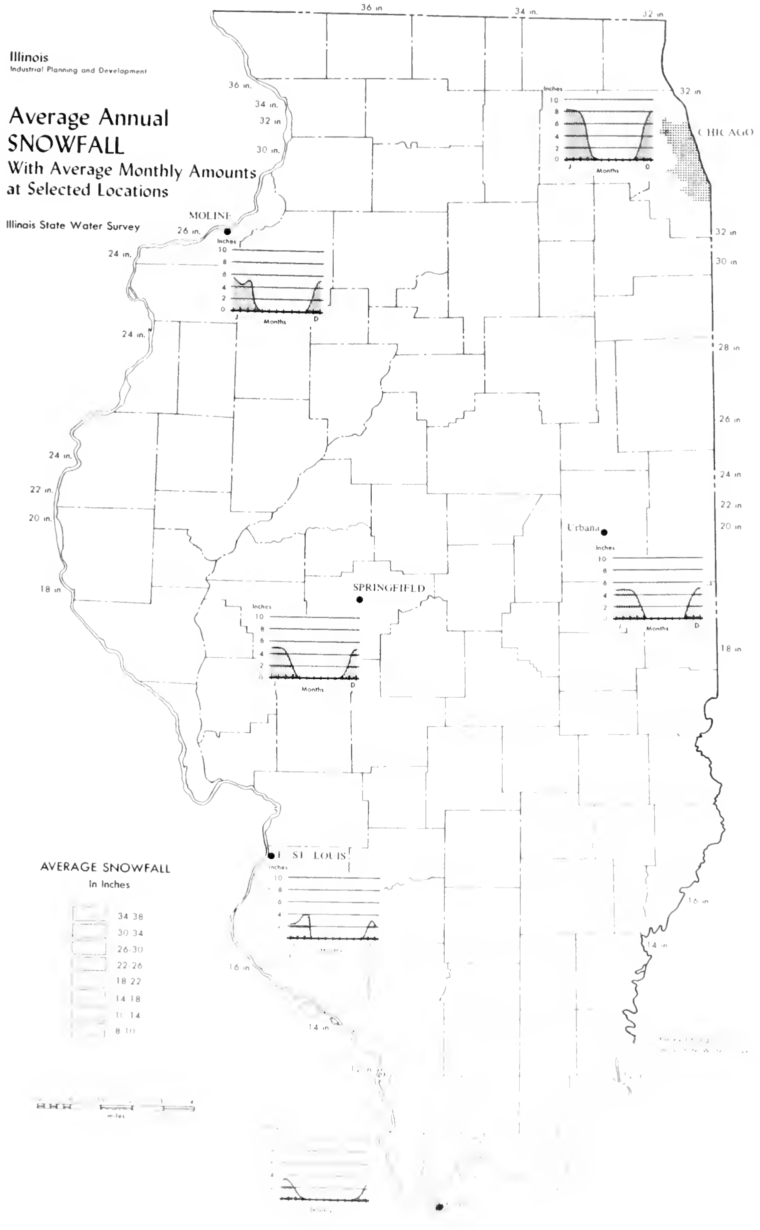
Record Maximum Snowfall

	Jan.	*Feb.*	*Mar.*	*Apr.*	*May*	*June*	*July*	*Aug.*	*Sept.*	*Oct.*	*Nov.*	*Dec.*	*Annual*
Rockford	36.1	21.8	23.5	9.0	1.5	T	0	0	T	5.0	14.8	26.5	62.1
Urbana	18.2	18.5	32.0	8.0	2.5	0	0	0	0	2.5	11.2	18.0	39.9
Cairo	24.2	11.7	11.7	1.6	1.5	T	0	0	0	2.0	6.1	22.7	47.7

Record Minimum Snowfall

	Jan.	*Feb.*	*Mar.*	*Apr.*	*May*	*June*	*July*	*Aug.*	*Sept.*	*Oct.*	*Nov.*	*Dec.*	*Annual*
Rockford	T	T	T	0	0	0	0	0	0	0	0	T	8.8
Urbana	T	T	0	0	0	0	0	0	0	0	0	T	6.7
Cairo	0	0	0	0	0	0	0	0	0	0	0	0	0.4

T = Trace


Illinois
Industrial Planning and Development
Average Annual
SNOWFALL
With Average Monthly Amounts
at Selected Locations
Illinois State Water Survey
CHICAGO
MOLINE
SPRINGFIELD
Urbana
ST LOUIS
Inches
Months
AVERAGE SNOWFALL
In Inches
34 38
30 34
26 30
22 26
18 22
14 18
10 14
8 10
miles
36 in.
34 in.
32 in.
30 in.
28 in.
26 in.
24 in.
22 in.
20 in.
18 in.
16 in.
14 in.

HEAVY SNOWFALL AND DEEP SNOW COVER

The average annual number of days with snowfalls of 1 inch or more varies from three in southern Illinois to thirteen in the northwestern part of the state. This northward increase is gradual throughout the southern half of Illinois, with Quincy and Urbana averaging only three more days per year than Cairo. However, north of a line from Quincy through Urbana—which is, incidentally, near the mean winter isotherm of 32° F.—the number of days increases quite rapidly. An average of nine days per year is reached at both Moline and Chicago.

The occurrence of heavy snowstorms—those yielding 4 inches or more snowfall in less than 48 hours—also reveals the same south-to-north increase. In southern Illinois a snowfall of this magnitude can be expected once a year. In central Illinois such snowstorms occur from one to two times a year, while in the north the average occurrences are between two and three a year.

The number of days with 1 inch or more of snow on the ground also has a distribution closely related to the north-south temperature pattern. On the average, over fifty days a year in northern Illinois have 1 inch or more of snow cover while only ten days a year have 1 inch or more of cover in southern Illinois.

OCCURRENCE OF ICING CONDITIONS

The distribution of the average annual number of days with icing conditions of sleet and glaze reveals an area of maximum occurrence in central Illinois. Glaze conditions occur in areas with temperatures at or near 32° F., during precipitation periods. The latitudinal distribution of temperatures during the winter is such that near freezing circumstances prevail with greater frequency in central Illinois than elsewhere in the state. The winter temperatures in southern Illinois are generally too warm to result in many glaze conditions, while the temperatures in northern Illinois are generally too cold.

The average annual occurrences of sleet vary only slightly from place to place in Illinois, with station averages ranging between five and seven days per year. Most of the variation in icing conditions relates to the glaze or freezing rain component, with areas of maximum development in central Illinois and near Lake Michigan.

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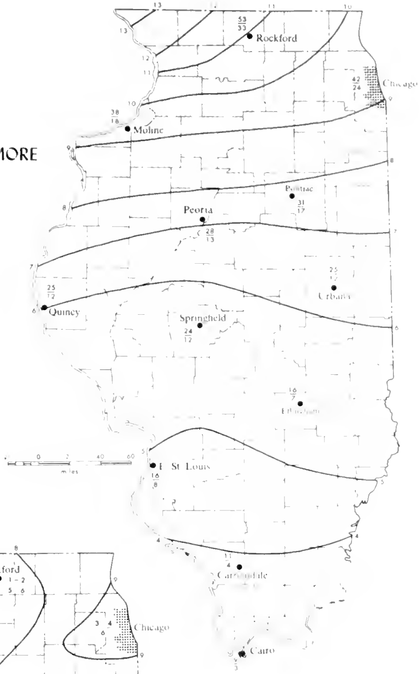
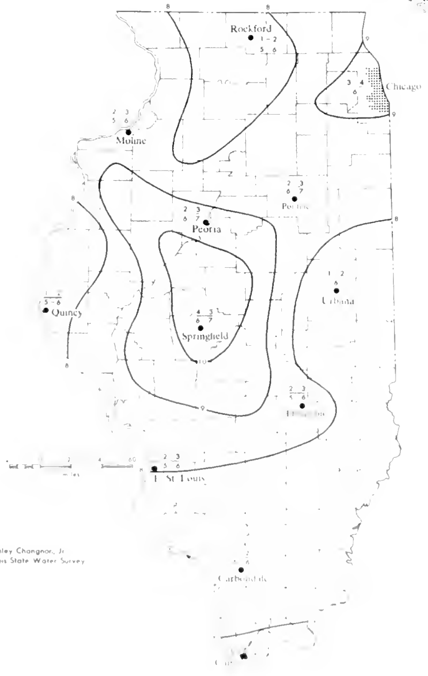
Average Annual Number of Days with SNOWFALL OF 1 INCH OR MORE And with Ground Snow Cover of 1 Inch or More and 3 Inches or More at Selected Locations

Average Number of Days

- 13-14
- 12-13
- 11-12
- 10-11
- 9-10
- 8-9
- 7-8
- 6-7
- 5-6
- 4-5
- 3-4

16 / 8 — Average number of days with 1 inch or more of ground snow cover / Average number of days with 3 inches or more of ground snow cover





Average Annual Number of Days with ICING CONDITIONS Glaze and Sleet

Average Number of Days

- 1 11
- 8 9

Average number of days with glaze
Average number of days with sleet

Illinois State Water Survey

Stanley Changnon, Jr.
Illinois State Water Survey

THUNDERSTORMS, HAIL, AND TORNADOES

The average annual frequency of thunderstorms in the Middle West decreases northward from the Gulf of Mexico. Storm activity in Illinois generally reflects this decrease with changing distance from the Gulf; there is an average annual occurrence of 58 thunderstorms in Cairo compared with 37 at Chicago. However, in western Illinois there is a northward increase in thunderstorms, as shown on the accompanying map, appearing primarily as an increase in the frequency of nocturnal thunderstorms, principally in August and September. June is the month of maximum thunderstorm occurrence throughout the state and January is the month when they are least in evidence.

Thunderstorms are a large contributor to the total precipitation of the state. The percent of the normal annual precipitation derived from this source increases from 38 percent in northeastern Illinois to over 44 percent in the south and to above 50 percent in the western section of the state. Thunderstorms make their greatest contribution to normal monthly rainfall during July, when 70 to 85 percent of the total is produced in this manner. Annual average thunderstorm precipitation is lowest in the northeast, where less than 13 inches fall, and highest in the south, where it measures over 19 inches.

The average annual occurrences of hail in Illinois have a varied distribution, with areas of maximum frequency in the unglaciated hill region of the northwest, the hill region of the south, and the Springfield Plain area in the southwest. These areas are identified in terms of surface features, since hail occurrences are considered to be related to conditions of topography. Hail occurrences vary considerably from year to year throughout the state. May, with an average of eight days, is the month of maximum activity. April, averaging six days, and March, averaging five days, rank second and third highest. Hail activity on a single day is more likely to be widespread during March and April than in other months.

The distribution of tornado occurrences for the 25-year period of 1927–1952 shows great areal variation. Some small areas in southern Illinois had as many as nine and other areas in southeastern and northeastern Illinois experienced as few as one for this period. One belt of maximum activity extends from the southwestern peak area northeastward through the Champaign-Danville area, and another such area extends northwestward towards Moline. Over 70 percent of all tornadoes in Illinois occur during a four-month period, March–June, and March is the month of maximum tornado activity.

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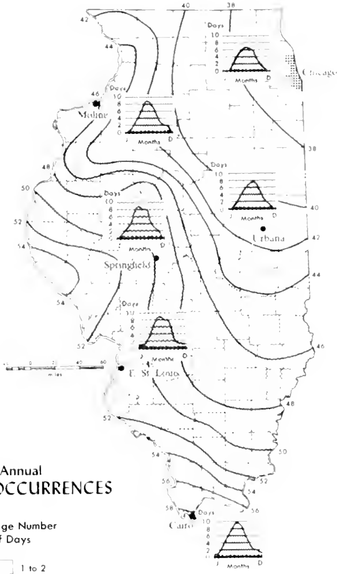
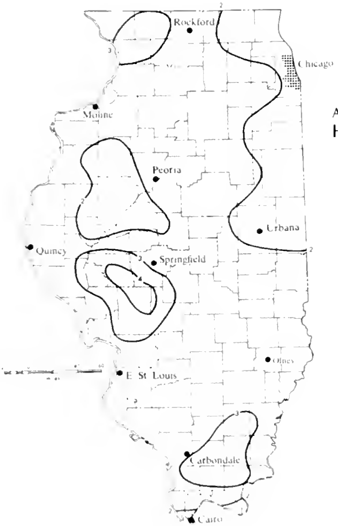
Average Annual THUNDERSTORMS With Average Monthly Occurrences at Selected Locations

Average Number of Occurrences

- 36-40
- 40-44
- 44-48
- 48-52
- 52-56
- 56-60



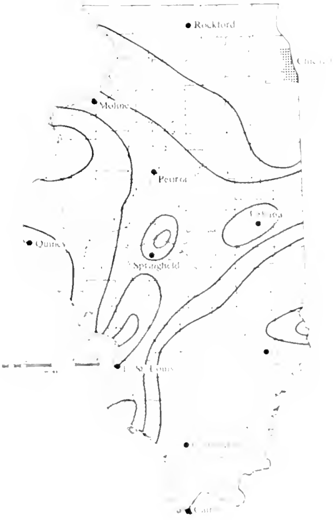


Average Annual HAIL OCCURRENCES

Average Number of Days

- 1 to 2
- 2 to 3
- 3 to 4
- 4 to 5

Illinois State Water Survey



TORNADO OCCURRENCES FOR 25 YEARS 1927-1952

Average Number of Occurrences

- 1 or 2
- 3 or 4
- 5 or 6
- 7 or 8
- 9 or 10

Stanley Changnon, Jr.
Illinois State Water Survey

TEMPERATURES

The continental climate of Illinois can be expected to exhibit extreme variations in temperature from day to day, month to month, and year to year. These variations will be considerably less, however, in the warmer half of the year than in the colder six-month period. While occasional spells of severe cold are a characteristic of southern Illinois winters, the climate during this season is basically milder here than in the rest of the state. Summers are commonly warm-to-hot and usually humid throughout Illinois. The annual mean temperature in northern Illinois is 48° F.; it is 60° F. in the south. An annual mean variation of 12 degrees exists, therefore, between these extremes of the state.

In July, the warmest month of the year, the mean monthly temperature in northern Illinois is 74° F. as compared to 80° F. for the southern part of the state. During January, the coldest month of the year, the mean for the extreme north is 20° F. as contrasted with 37° F. in the south. The July difference in means, shown from the above, is 6 degrees, while the January difference is 17 degrees.

The range in the mean monthly maximum temperatures and the mean monthly minimum temperatures also shows north-south variation, as will be noted from the data for selected stations on the map. However, it can be observed that a greater latitudinal difference exists between the mean monthly maximum values than between the mean monthly minimum values. Only slight local irregularities affect the uniform east-west orientation of the isotherms in all months.

The uniformity of temperatures over the state during the warmer half-year is indicated by the fact that an average of 28 to 30 days with a maximum temperature above 90° F. is recorded in northern Illinois, while 35 to 40 days above 90° F. are noted in southern Illinois. However, a greater areal variation in temperatures during the winter is reflected by the average number of days with minimum temperatures below 0° F. These average 2 days in southern Illinois, 8 in central Illinois, and 12 in the north.

Illinois
Industrial Planning and Development

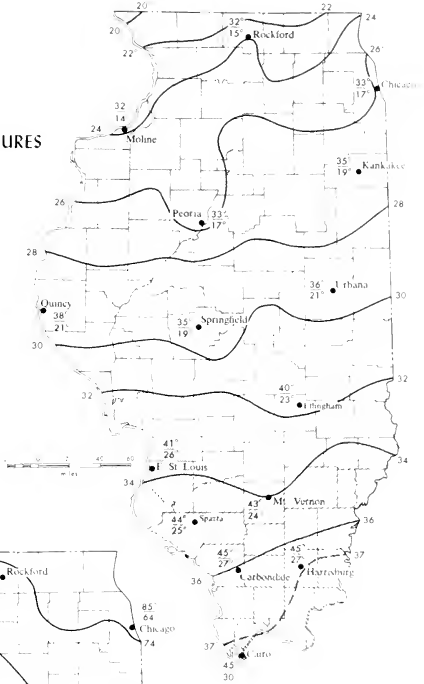
MEAN JANUARY TEMPERATURES

Illinois State Water Survey

Temperatures
In Degrees Fahrenheit

18-20
20-22
22-24
24-26
26-28
28-30
30-32
32-34
34-36
36-38

38 Mean maximum January temperature
21 Mean minimum January temperature



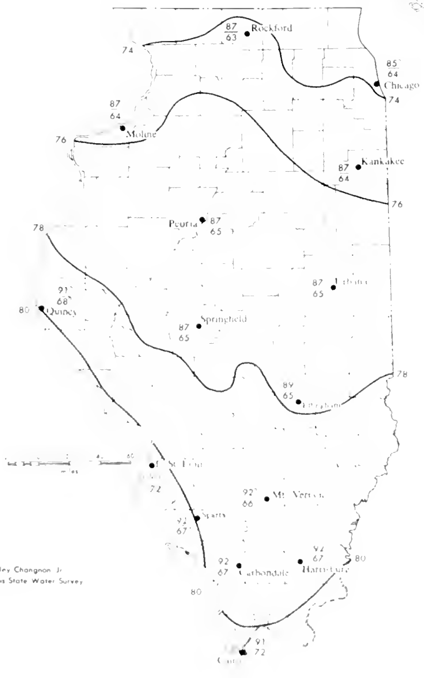
MEAN JULY TEMPERATURES

Illinois State Water Survey

Temperatures
In Degrees Fahrenheit

72-74
74-76
76-78
78-80
80-82

89 Mean maximum July temperature
65 Mean minimum July temperature



Stanley Changnon Jr.
Illinois State Water Survey

HEATING AND COOLING DEGREE DAYS

Heating and cooling degree days are units designed for measuring heating and cooling requirements. Calculating limits of 65° and 75° F. were selected as points of reference in the temperature scale where heating or cooling are necessary to maintain comfort. For instance, where the daily mean temperature is below 65° F., heating is necessary to maintain conditions of comfort for normal activities in any type of roofed enclosure. The map presentation can be used to illustrate the need for considerably more cooling volume in air conditioning systems in southern Illinois than in the north.

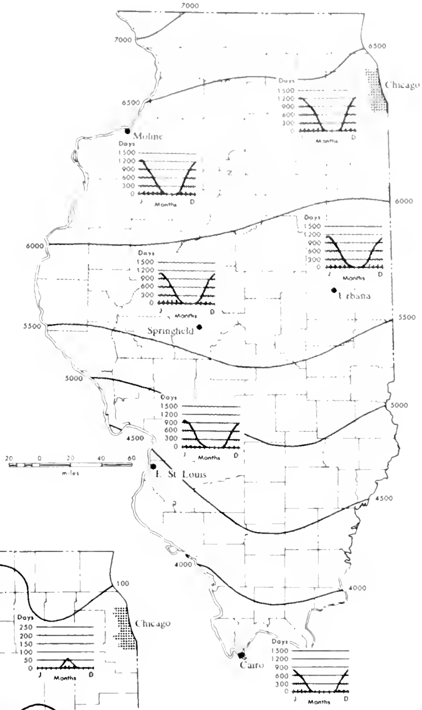
Heating degree days are computed directly from mean temperatures and, consequently, have a latitudinal distribution in Illinois. They are determined by subtracting the daily mean temperature from 65 degrees and counting every degree of difference as one degree day. For instance, a day with a 54° F. mean temperature is counted as 11 degree days. A low number of degree days exists in southern Illinois, normally less than 4000 per year, while a high of over 7000 per year is recorded, on the average, for the extreme northwestern part of the state. Except for local irregularities, the monthly distributions also reveal a south-to-north increase. January has the highest monthly averages and July has the lowest. No degree days are recorded for three months of the year, on the average, in southern Illinois. On the other hand, heating degree days are reported for all months in the north.

Cooling degree days also reveal a distinct latitudinal distribution in the state. However, the north-south range from 100 to 600 cooling degree days annually is greater percentagewise than the heating degree day range of from 4000 to 7000 over the same area. Cooling degree days are computed by subtracting 75 degrees from the daily mean temperature. Every degree of difference calculated on this basis is counted as a cooling degree day. July is the month with the most cooling degree days, while several of the colder months record no cooling degree days whatever. Cooling degree days are recorded, on the average, during five months of the year in northern Illinois and seven months of the year in the south.

Illinois
Industrial Planning and Development

Average Annual HEATING DEGREE DAYS*
With Average Monthly Number at Selected Locations

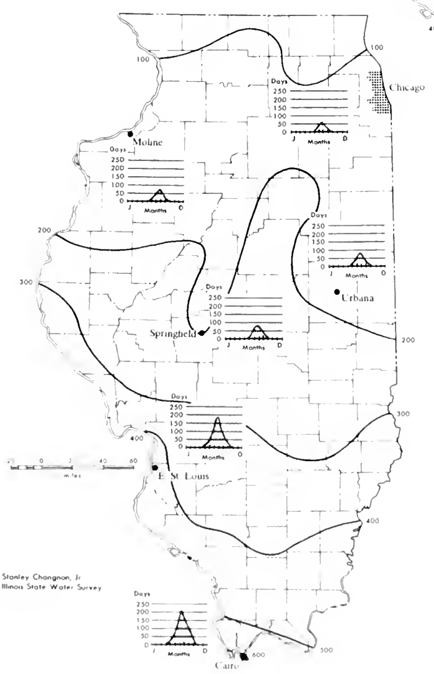
Illinois State Water Survey



Degree Days

	7000-7500
	6500-7000
	6000-6500
	5500-6000
	5000-5500
	4500-5000
	4000-4500
	3500-4000

*Average of the yearly accumulation of daily degree differences between 65°F and the daily mean temperature below 65°



Average Annual COOLING DEGREE DAYS**
With Average Monthly Number at Selected Locations

Degree Days

	Less than 100
	100-200
	200-300
	300-400
	400-500
	500-600
	600-700

**Average of the yearly accumulat[illegible] degree differences between 75°F [illegible] daily mean temperature above [illegible]

Stanley Changnon, Jr
Illinois State Water Survey

GROWING SEASON

The average length of the growing season conforms to temperature distributions in Illinois with a north-to-south increase in the length of the period. However, the Mississippi, Wabash, and Illinois River valleys appear to influence the growing season pattern by increasing the length of the season along their courses, as may be noted on the map.

The average length of the growing season is defined as the number of days between the last average date of killing frost in the spring and the first average date of killing frost in the fall. Average dates for the fall frost vary from early October in northern Illinois to late October in the south. Average dates for the spring also show a latitudinal variation, but the north-to-south difference is greater at this period than in the fall. In southern Illinois, the end of March is normally the time of the last killing frost, while the end of the first week in May is the comparable period for the last killing frost in the north. The local influence of Lake Michigan and the Chicago urban area cause the eastern portion of Cook County to have a slightly longer growing season than the surrounding territory.

Dates of killing frosts can vary considerably from year to year, thus producing growing seasons of varying lengths. For instance, at Springfield the average growing season is 187 days, but there has been a season with 138 days, the shortest on record, and one with 231 days, the longest on record. On the average, the earliest dates on record for killing frosts in the fall are 29 days before the average frost dates. In the spring, the latest dates of killing frost on record are, on the average, 31 days after the average dates of killing frost.

The probabilities of the last killing frost of spring and the first killing frost of fall having occurred by particular dates are indicated for selected locations in the accompanying tables. As an example, the last killing frost of spring will have occurred at Chicago by April 16 in 50 percent of the years.

CHANCE OF LAST KILLING FROST OF SPRING HAVING OCCURRED BY A PARTICULAR DATE

Percent Chance	*0%*	*25%*	*50%*	*75%*	*100%*
Chicago	Mar. 20	Apr. 6	Apr. 16	Apr. 22	May 23
Peoria	Mar. 28	Apr. 9	Apr. 15	Apr. 23	May 9
Springfield	Mar. 22	Apr. 3	Apr. 15	Apr. 16	May 25
Mt. Vernon	Mar. 20	Apr. 9	Apr. 16	Apr. 23	May 7
Cairo	Mar. 3	Mar. 17	Mar. 30	Apr. 7	Apr. 24

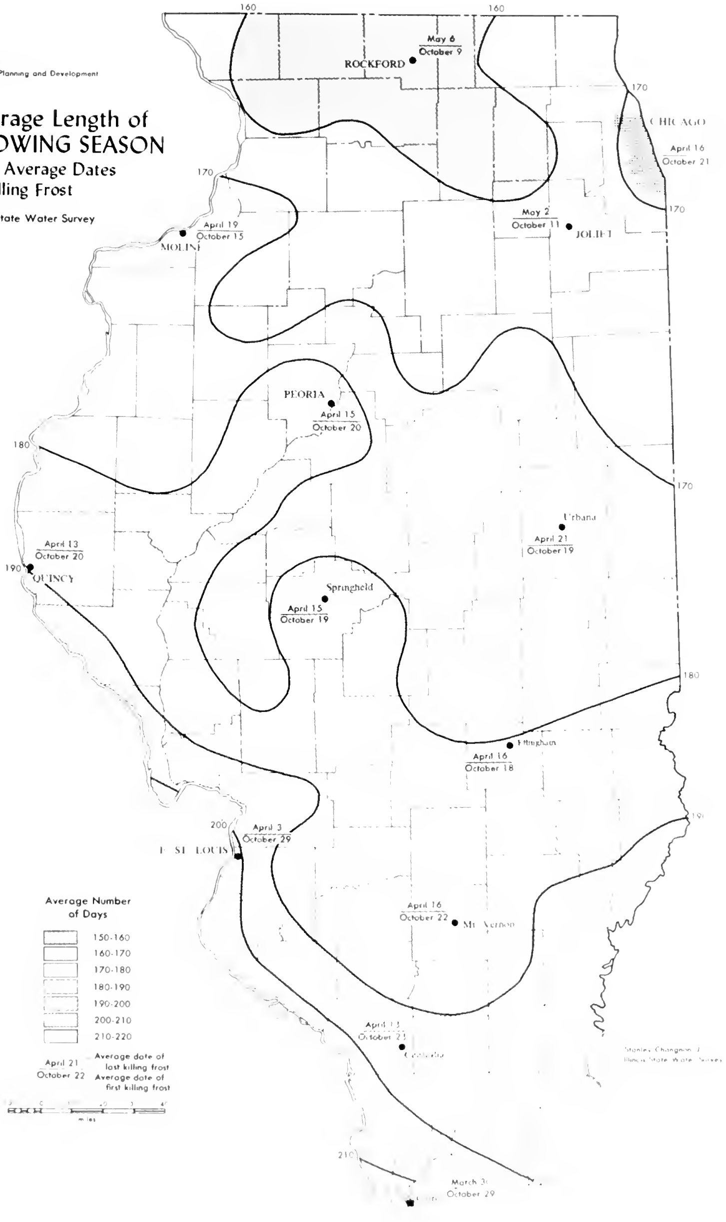
CHANCE OF FIRST KILLING FROST OF FALL HAVING OCCURRED BY A PARTICULAR DATE

Percent Chance	*0%*	*25%*	*50%*	*75%*	*100%*
Chicago	Sept. 25	Oct. 14	Oct. 21	Nov. 4	Nov. 24
Peoria	Sept. 26	Oct. 12	Oct. 20	Oct. 29	Nov. 12
Springfield	Sept. 26	Oct. 12	Oct. 19	Nov. 1	Nov. 23
Mt. Vernon	Sept. 15	Oct. 12	Oct. 22	Oct. 28	Nov. 10
Cairo	Sept. 30	Oct. 24	Oct. 29	Nov. 9	Nov. 27

Illinois
Industrial Planning and Development

Average Length of GROWING SEASON
With Average Dates of Killing Frost

Illinois State Water Survey



ILLINOIS WATER RIGHTS LAW

The availability of water for industrial and other uses includes consideration of not only the presence or absence of water in an area but also of the permissive and restrictive water rights laws which govern the use of the water that does exist.

In Western states extensive litigation and conflict over these questions has been brought about because of severe shortages of water. Illinois has been spared many of these difficulties in the past because the state has had an adequate supply of water. This bounty has led to a relatively meager set of water laws and many questions cannot be answered with authority. Nevertheless the implications for agricultural, industrial, and municipal development and economic growth inherent in these laws are obvious. The following is a brief summary of pertinent aspects of Illinois Water Rights Law.*

American Water Law

Although the modern scientist views water in terms of the hydrologic cycle and sees all aspects of water as part of a single pattern, the law, largely for historical reasons, has created artificial classifications for handling water disputes. Different rules have developed for water in natural watercourses (rivers, streams, and lakes), for diffused surface water, and for ground water (really underground or subterranean water, called percolating water if it is not a well-defined underground stream).

The 31 Eastern states follow the riparian doctrine as to water in natural watercourses; the 17 Western states follow the prior appropriation doctrine. The former doctrine is based on the idea that the water can be used only by those individuals who own land bordering on the river, stream, or lake or by someone who has obtained permission from such owner. This means that water is treated, in essence, as a private property right, although each owner has only the use of the water rather than the absolute possessory right. The latter doctrine is based on ownership by the people or the state, with permission to use granted as a property right on the basis of priority in time. Both broad doctrines have various interpretations; thus, riparian rights may follow the reasonable use theory or the natural flow theory or a combination of the two.

Ground water, too, is subject to varying legal theories. The Eastern states usually follow the English rule of absolute ownership by the surface owner, some carrying the rule so far that even malicious use by the owner is privileged. Others say the use must be reasonable and prohibit use away from the surface land if it

*This statement is extracted from a 73-page report prepared on this topic by Professor John E. Cribbet for the Water Resources Committee of the Illinois State Chamber of Commerce, dated January 1958. The full report, available for $1.00 at the Illinois State Chamber of Commerce, 20 North Wacker Drive, Chicago, should be used by anyone to whom the use of water is of vital concern.

unreasonably harms a neighboring owner. Many of the Western states have adopted some version of the appropriation doctrine even for ground water and California has developed a new concept, entitled the correlative rights doctrine.

Diffused surface water, flowing off the land after rains or snow melt, has not raised any serious questions as to use and it is generally assumed that an owner can make any use he desires of water which falls on his own land. The major problem here has been how to get rid of surface water, i.e., drainage. Again, various theories have evolved, the two principal ones being the common enemy rule and the civil law rule of Roman Law adapted to the American scene, in Illinois modified and augmented by a modern Drainage Code.

Illinois Water Law—the Common Law

Illinois is a strong common-law state, i.e., it is committed to the legal principles laid down by the English and early American judicial decisions.

Water Rights Law Pertaining to Water in Natural Watercourses. The cases concerning water in natural watercourses have tended to deal with matters of pollution and diversion rather than consumption, but there are a sufficient number of decisions to form at least a working base. Illinois follows the common-law riparian rights doctrine as interpreted by both the natural flow and the reasonable use theories. It has expressly repudiated the doctrine of prior appropriation and has recognized the inadequacy of the natural flow theory as a test for all riparian rights.

Under the riparian doctrine water uses are divided into natural and artificial uses. Natural uses represent needs that must be supplied if man is to exist—drinking purposes, household wants, and water for his cattle or stock. For such purposes a riparian owner may take all of the water he actually needs. On the other hand, artificial uses are those which supply the comfort and increase the prosperity of the landowner—such as irrigating lands or industrial applications. Water for artificial uses must be on a reasonable basis and one owner can not deprive another of a proportionate use of the water for this purpose. In diversion cases the natural flow theory may still prevail, but for pollution and consumption the reasonable use test is more frequently used. The decisions distinguish between natural and artificial uses of water and place both industrial and agricultural uses in the latter class but do not establish any priority between them.

All water rights are recognized as vested property rights and the owner can not be deprived of them except by due process of law. This means that such rights must be bargained for like any other property interest or taken by condemnation proceedings after due compensation is paid. Condemnation can take place only if the taker has the power of eminent domain. Municipalities are treated like any other riparian owner, except that they have the power to condemn.

Water Rights Law Pertaining to Ground Water. The Illinois law of ground water rests on a single case decided in 1899 (Edwards v. Haeger) which places the state

in the list of those following the English common law. In the basic case the court held that "Water which is the result of natural and ordinary percolation through the soil is part of the land itself and belongs absolutely to the owner of the land, and, in the absence of any grant, he may intercept or impede such underground percolations, though the result be to interfere with the source of supply of springs or wells on adjoining premises." However, the owner may not maliciously injure his neighbor. In the proper case Illinois would probably modify this view by a doctrine of reasonable use.

Illinois Water Law—Legislation

The water legislation in Illinois is varied in scope. The bulk of the legislation relates to such matters as drainage, navigation, pollution, and sanitation; areas that have an indirect impact on the problems of water consumption. A few statutes have a direct bearing on consumption.

Legal duties, powers, and functions are spread among a number of governmental units, from local districts to various departments of the state government. Details of such statutory law are available, but are beyond the scope of this summary.

Use of Lake Michigan Water

The law relating to the use of Lake Michigan water is not discussed here except as the normal doctrine of riparian rights applies to that body of water. This important subject is excluded because it involves not only local and state considerations but also interstate, federal, and international (United States and Canadian) policies and arguments.

MAJOR STATE AGENCIES DEALING WITH WATER SUPPLIES

There are several state agencies which have major responsibilities for the investigation, development, and protection of water resources and the services of these agencies are available for consultation on many types of water problems. The agencies mentioned below are those with primary responsibilities in water resources, although there are other state agencies with an interest in water.

Water Survey Division and Geological Survey Division of the Department of Registration and Education, Urbana, Illinois. The Water Survey studies many aspects of the nature and extent of the state's water resources, including ground water levels, precipitation, surface water supplies, stream gaging, and siltation of water impoundment reservoirs. Information on the mineral quality of water and engineering information about well yields and water levels can be secured from this source. The Geological Survey deals with the geological aspects of ground water supply. These two agencies work closely together and have a storehouse of information available to all interested persons on most aspects of local water supplies.

Division of Waterways of the Department of Public Works and Buildings, Springfield, Illinois. This agency has general supervision of all public bodies of water in the state, including those lakes, streams, canals, and rivers not owned by private interests, municipal corporations, or the United States Government. It administers more than 50 laws and regulations which protect the public interests in these waters. It regulates construction in public waters, prevents obstruction of navigation in navigable watercourses, supervises planning and construction of flood control works, operates moveable bridges over the Illinois waterway and makes general surveys and investigations of Illinois watercourses.

Division of Sanitary Engineering of the Department of Public Health, Springfield, Illinois. Among other activities, this division acts in a supervisory capacity relative to the sanitary quality, mineral quality, and adequacy of proposed and existing public water supplies, treatment, and purification works. The division also supplies the technical staff for the administrative activities of the Sanitary Water Board.

The Sanitary Water Board is charged "to control, prevent, and abate pollution of the streams, lakes, ponds, and other surface and underground waters in the state. . . ." Among the functions of the board are: reviewing plans and specifications for proposed domestic and industrial waste treatment works operation, making necessary investigations and reports upon natural waters, and conducting all other activities pertinent to a successful stream sanitation and conservation program.

Division of Oil and Gas of the Department of Mines and Minerals, Springfield, Illinois. This division has jurisdiction over pollution of land and water resulting from oil field operations and issues permits for rock water wells.

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Stream measurements: Nos. 83, 98, 128, 171, 207, 245, 265, 285, 305, 325, 355, 385, 405, 435, 455, 475, 505, 525, 545, 565, 585, 605, 625, 645, 665, 685, 700, 715, 730, 745, 760, 785, 805, 825, 855, 875, 895, 925, 975, 1005, 1035, 1055, 1085, 1115, 1145, 1175, 1278.
Underground waters, artesian pressure: Nos. 908, 938, 946, 988, 1018, 1025, 1073, 1098, 1128, 1158, 1167.
Quality: Nos. 239, 1186.
Southwestern Illinois: No. 164.
Springs: Nos. 114, 164.
Wells: Nos. 57, 114, 149, 164, 364, 946.

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GLOSSARY FOR WATER RESOURCES AND CLIMATE

Acre-Foot. A term used in measuring the volume of water, equal to the quantity of water required to cover an acre 1 foot in depth, or 43,560 cubic feet.

Aquifer. A geologic formation that is water-bearing and which transmits water from one point to another.

Artesian Aquifer. A soil or rock formation which is confined above and below and in which water is under pressure.

Cubic Foot per Second. A unit of discharge for measurement of flowing liquid, equal to a flow of one cubic foot per second past a given section. Also called Second Foot.

Dam. A barrier constructed across a water course for the purpose of (1) creating a reservoir, (2) diverting water from a conduit or channel, (3) creating a head which can be used to generate power, and (4) improving river navigability.

Drainage. An area from which surface runoff is carried away by a single drainage system. Also called Watershed and Drainage Area.

Drawdown. The change in surface elevation of a body of water as a result of the withdrawal of water.

Flood. A relatively high flow as measured by either gage height or discharge quantity.

Ground Water. Subsurface water occupying the zone of saturation. In a strict sense the term applies only to water below the water table.

Hardness. A characteristic of water, chiefly due to the existence therein of the carbonates and sulfates and occasionally the nitrates and chlorides of calcium, iron, and magnesium. It is commonly computed from the amounts of calcium and magnesium in the water and expressed as equivalent calcium carbonate.

Head. The vertical height of a water column or its equivalent pressure in other units.

Hydrology. The applied science concerned with the waters of the earth—their occurrences, distribution, and circulation through the hydrologic cycle.

Hydrologic Cycle. A complete cycle through which water passes, commencing as atmospheric water vapor, passing into liquid and solid form as precipitation, thence along or into the ground surface, and finally again returning to the atmosphere as water vapor by means of evaporation and transpiration.

Impervious. A term applied to a material through which water cannot pass. It is also applied to material through which water passes with great difficulty.

Intake. The surface area upon which water that eventually reaches an aquifer or ground water basin is initially absorbed. Also called Catchment Area.

Irrigation. The artificial application of water to lands for agricultural purposes.

Permeability. The property of the material which permits appreciable movement of water through it when saturated and actuated by hydrostatic pressure of a magnitude normally encountered in natural subsurface water.

Reservoir. A pond, lake, tank, basin, or other space, either natural or created in whole or in part by the building of engineering structures, which is used for storage, regulation, and control of water.

Sedimentation. The process of subsidence and deposition of suspended matter carried by water. It is usually due to a reduction of the velocity of water below the point where the suspended material can be transported.

Till. Deposits of glacial drift laid down in place as the glacier melts. These deposits are unsorted and unstratified rock, flour, sand, pebbles, cobbles, and boulders.

Transmissibility. The number of gallons of water a day that percolate under prevailing conditions through each square mile of water-bearing bed for each foot thickness of bed.

Transpiration. A process by which plants dissipate water into the atmosphere from their leaves and other surfaces.

Water-Bearing. A term, more or less relative, used to designate a formation that contains considerable ground water. It is usually applied to formations from which the ground water may be extracted by pumping, drainage, etc.

Zone of Saturation. The zone below the water table in which pores of the soil are completely saturated with water.

Colder Half-Year. A period of six months including October, November, December, January, February, and March.

Degree Days, Cooling. These units are used to give an index for cooling requirements and are computed for each day by subtracting 75 degrees from the daily mean temperature (Fahrenheit).

Degree Days, Heating. These units are used to give an index for heating requirements and are computed for each day by subtracting the daily mean temperature from 65 degrees (Fahrenheit).

Glaze. Rain that falls in liquid form and freezes to objects on the ground. Also known as freezing rain and often referred to as ice storms.

Growing Season. This period is the number of days between the last spring date with a temperature of 32° F. or lower and the first fall date with a temperature of 32° F. or lower.

Isotherm. A line on the earth's surface joining points of the same temperature at a given time or for a given period.

Mean Monthly Maximum Temperature. This is computed by adding all the daily maximum temperatures in the month and dividing this total by the number of days in the month.

Mean Monthly Minimum Temperature. This is computed by adding all the daily minimum temperatures in the month and dividing this total by the number of days in the month.

Mean Monthly Temperature. This is computed by adding the mean monthly maximum temperature and the mean monthly minimum temperature and dividing this total by two.

Nocturnal Thunderstorms. Thunderstorms that occur at night.

Precipitation. All water which falls to the earth's surface, including hail, snow, and sleet as well as rainfall.

Sleet. Transparent grains of ice formed by raindrops freezing as they fall.

Snow. White or transparent ice crystals, often in complex hexagonal forms.

Warmer Half-Year. A period of six months including April, May, June, July, August, and September.

INDEX OF COUNTIES, CITIES, AND TOWNS

Incorporated Cities and Towns with Populations of 1000 or more in 1950

COUNTIES

County	*Map Coordinate*	*County*	*Map Coordinate*	*County*	*Map Coordinate*	*County*	*Map Coordinate*
Adams	A-8	Ford	G-6	Livingston	G-5	Randolph	D-13
Alexander	E-16	Franklin	F-13	Logan	E-7	Richland	H-11
Bond	E-11	Fulton	D-6	McDonough	B-6	Rock Island	B-4
Boone	F-1	Gallatin	H-14	McHenry	G-1	St. Clair	D-12
Brown	B-8	Greene	C-10	McLean	F-6	Saline	G-14
Bureau	E-4	Grundy	G-4	Macon	F-8	Sangamon	E-9
Calhoun	B-10	Hamilton	G-13	Macoupin	D-10	Schuyler	C-7
Carroll	D-2	Hancock	A-7	Madison	D-11	Scott	C-9
Cass	C-8	Hardin	H-15	Marion	F-12	Shelby	G-10
Champaign	H-7	Henderson	B-5	Marshall	F-5	Stark	D-5
Christian	E-9	Henry	D-4	Mason	D-7	Stephenson	E-1
Clark	J-10	Iroquois	J-6	Massac	F-16	Tazewell	E-6
Clay	G-11	Jackson	E-14	Menard	D-8	Union	E-15
Clinton	E-12	Jasper	H-10	Mercer	B-4	Vermilion	J-7
Coles	H-9	Jefferson	F-13	Monroe	C-13	Wabash	J-12
Cook	J-2	Jersey	C-10	Montgomery	E-10	Warren	C-6
Crawford	J-11	Jo Daviess	C-1	Morgan	C-8	Washington	E-12
Cumberland	H-10	Johnson	F-15	Moultrie	G-9	Wayne	G-12
De Kalb	F-2	Kane	G-2	Ogle	E-2	White	H-13
De Witt	F-7	Kankakee	H-4	Peoria	D-5	Whiteside	D-3
Douglas	H-8	Kendall	G-3	Perry	E-13	Will	H-4
Du Page	H-2	Knox	C-5	Piatt	G-8	Williamson	F-14
Edgar	J-9	Lake	H-1	Pike	B-9	Winnebago	F-1
Edwards	H-12	La Salle	F-4	Pope	G-15	Woodford	F-5
Effingham	G-10	Lawrence	J-11	Pulaski	F-16		
Fayette	F-10	Lee	E-3	Putnam	E-4		

CITIES AND TOWNS

Place	*Map Coordinate*	*Population*	*County*	*Place*	*Map Coordinate*	*Population*	*County*
Abington	C-5	3,330	Knox	Auburn	D-9	1,963	Sangamon
Albion *	H-12	2,287	Edwards	Aurora	G-3	50,576	Kane
Aledo *	B-4	2,919	Mercer	Barrington	H-1	4,209	Cook-Lake
Algonquin	G-1	1,223	McHenry	Barry	B-9	1,529	Pike
Alorton	C-12	2,547	St. Clair	Bartonville	E-6	2,437	Peoria
Alsip	J-3	1,228	Cook	Batavia	G-2	5,838	Kane
Altamont	G-10	1,580	Effingham	Beardstown	C-8	6,080	Cass
Alton	C-11	32,550	Madison	Beckemeyer	E-12	1,045	Clinton
Amboy	E-3	2,128	Lee	Belleville *	D-12	32,721	St. Clair
Anna	E-15	4,380	Union	Bellevue	E-6	1,529	Peoria
Antioch	H-1	1,307	Lake	Bellwood	H-2	8,746	Cook
Arcola	G-9	1,700	Douglas	Belvidere *	F-1	9,422	Boone
Arlington Hts.	H-2	8,768	Cook	Bement	G-8	1,459	Piatt
Arthur	G-8	1,573	Douglas-Moultrie	Benld	D-10	2,093	Macoupin
				Bensenville	H-2	3,754	Du Page
Ashland	D-8	1,039	Cass	Benton *	F-13	7,848	Franklin
Assumption	F-9	1,466	Christian	Berkeley	H-2	1,882	Cook
Astoria	C-7	1,308	Fulton	Berwyn	J-2	51,280	Cook
Athens	D-8	1,048	Menard	Bethalto	D-11	2,115	Madison
Atlanta	E-7	1,331	Logan	Bloomington *	F-6	34,163	McLean

* County Seat

Place	*Map Coordinate*	*Population*	*County*
Blue Island	J-3	17,622	Cook
Bourbonnais	H-4	1,598	Kankakee
Bradley	H-4	5,699	Kankakee
Braidwood	H-4	1,485	Will
Breese	E-12	2,181	Clinton
Bridgeport	J-11	2,358	Lawrence
Bridgeview	J-3	1,393	Cook
Broadview	H-2	5,196	Cook
Brookfield	H-2	15,472	Cook
Brooklyn	C-12	2,568	St. Clair
Brookport	G-16	1,119	Massac
Bunker Hill	D-11	1,238	Macoupin
Burnham	J-3	1,331	Cook
Bushnell	C-6	3,317	McDonough
Byron	E-1	1,237	Ogle
Cairo *	F-16	12,123	Alexander
Calumet City	J-3	15,799	Cook
Calumet Park	J-3	2,500	Cook
Cambridge *	C-4	1,489	Henry
Canton	D-6	11,927	Fulton
Carbondale	F-14	10,921	Jackson
Carlinville *	D-10	5,116	Macoupin
Carlyle *	E-12	2,669	Clinton
Carmi *	H-13	5,574	White
Carpentersville	H-2	1,523	Kane
Carrier Mills	G-14	2,252	Saline
Carrollton *	C-10	2,437	Greene
Carterville	F-14	2,716	Williamson
Carthage *	A-7	3,214	Hancock
Casey	H-10	2,734	Clark
Caseyville	D-12	1,209	St. Clair
Central City	F-12	1,231	Marion
Centralia	F-12	13,863	Clinton-Marion
Cerro Gordo	G-8	1,052	Piatt
Champaign	H-7	39,563	Champaign
Charleston *	H-9	9,164	Coles
Chatsworth	G-6	1,119	Livingston
Chenoa	G-6	1,452	McLean
Chester *	D-14	5,389	Randolph
Chicago *	J-2	3,620,962	Cook
Chicago Hts.	J-3	24,551	Cook
Chillicothe	E-5	2,767	Peoria
Chrisman	J-8	1,071	Edgar
Christopher	F-14	3,545	Franklin
Cicero	J-2	67,544	Cook
Clarendon Hills	H-3	2,437	Du Page
Clay City	G-11	1,103	Clay
Clinton *	F-7	5,945	De Witt
Coal City	G-4	2,220	Grundy
Cobden	E-15	1,104	Union
Colchester	B-7	1,551	McDonough
Collinsville	D-12	11,862	Madison-St. Clair
Columbia	C-12	2,179	Monroe
Coulterville	E-13	1,160	Randolph
Crete	J-3	2,298	Will
Creve Coeur	E-6	5,499	Tazewell
Crotty	G-4	1,435	La Salle
Crystal Lake	G-1	4,832	McHenry
Cuba	C-6	1,482	Fulton
Dallas City	A-6	1,275	Hancock-Henderson
Danville *	J-7	37,864	Vermilion
Decatur *	F-8	66,269	Macon
Deerfield	J-1	3,288	Lake
De Kalb	G-2	11,708	De Kalb
Delavan	E-7	1,248	Tazewell
Depue	E-4	2,163	Bureau
Des Plaines	H-2	14,994	Cook
Divernon	E-9	1,013	Sangamon
Dixmoor	J-3	1,327	Cook
Dixon *	E-2	11,523	Lee
Dolton	J-3	5,558	Cook
Downers Grove	H-3	11,886	Du Page
Dupo	C-12	2,239	St. Clair
Du Quoin	E-14	7,147	Perry
Dwight	G-5	2,843	Livingston
Earlville	F-3	1,217	La Salle
East Alton	D-11	7,290	Madison
East Chicago Hts.	J-3	1,548	Cook
East Dubuque	C-1	1,697	Jo Daviess
East Dundee	H-2	1,466	Kane
East Hazel Crest	J-3	1,066	Cook
East Moline	C-3	13,913	Rock Island
East Peoria	E-5	8,698	Tazewell
East St. Louis	C-12	82,295	St. Clair
Edwardsville *	D-11	8,776	Madison
Effingham *	G-10	6,892	Effingham
Eldorado	G-14	4,500	Saline
Elgin	G-2	44,223	Cook-Kane
Elmhurst	H-2	21,273	Du Page
Elmwood	D-5	1,613	Peoria
Elmwood Park	J-2	18,801	Cook
El Paso	F-6	1,818	Woodford
Erie	D-3	1,180	Whiteside
Eureka *	E-6	2,367	Woodford
Evanston	J-2	73,641	Cook
Evergreen Park	J-3	10,531	Cook
Fairbury	G-6	2,433	Livingston
Fairfield *	G-12	5,576	Wayne
Fairmont City	D-12	2,284	St. Clair
Farmer City	G-7	1,752	De Witt
Farmington	D-6	2,651	Fulton
Flora	G-12	5,255	Clay
Flossmoor	J-3	1,804	Cook
Forest Park	J-2	14,969	Cook
Forrest	G-5	1,040	Livingston
Forreston	E-2	1,048	Ogle
Fox Lake	H-1	2,238	Lake
Fox River Grove	H-1	3,313	McHenry
Franklin Park	H-2	8,899	Cook
Freeburg	D-12	1,661	St. Clair
Freeport *	E-1	22,467	Stephenson
Fulton	D-2	2,706	Whiteside
Galena *	C-1	4,648	Jo Daviess
Galesburg *	C-5	31,425	Knox
Galva	D-4	2,886	Henry
Geneseo	D-3	4,325	Henry
Geneva *	G-2	5,139	Kane
Genoa	G-2	1,690	De Kalb
Georgetown	J-8	3,294	Vermilion

* County Seat

Place	*Map Coordinate*	*Population*	*County*	*Place*	*Map Coordinate*	*Population*	*County*
Gibson	G-6	3,029	Ford	Lawrenceville *	J-11	6,328	Lawrence
Gillespie	D-10	4,105	Macoupin	Lebanon	D-12	2,417	St. Clair
Gilman	H-5	1,602	Iroquois	Lemont	H-3	2,757	Cook
Girard	D-9	1,740	Macoupin	Lena	D-1	1,227	Stephenson
Glen Carbon	D-11	1,176	Madison	Le Roy	F-7	1,820	McLean
Glencoe	J-1	6,980	Cook	Lewistown *	D-7	2,630	Fulton
Glen Ellyn	H-2	9,524	Du Page	Lexington	F-6	1,181	McLean
Glenview	J-2	6,142	Cook	Libertyville	H-1	5,425	Lake
Golconda *	G-15	1,066	Pope	Lincoln *	E-7	14,362	Logan
Grafton	C-11	1,117	Jersey	Lincolnwood	J-2	3,072	Cook
Grandview	E-8	1,349	Sangamon	Litchfield	E-1	7,208	Montgomery
Granite City	C-12	29,465	Madison	Lockport	H-3	4,955	Will
Grays Lake	H-1	1,970	Lake	Lombard	H-2	9,817	Du Page
Grayville	H-13	2,461	White-	Loves Park	F-1	5,366	Winnebago
			Edwards	Lovington	G-9	1,152	Moultrie
Greenup	H-10	1,360	Cumberland	Lyons	J-2	6,120	Cook
Greenville *	E-11	4,069	Bond	McHenry	H-1	2,080	McHenry
Griggsville	B-9	1,199	Pike	McLeansboro *	G-13	3,008	Hamilton
Gurnee	H-1	1,097	Lake	Mackinaw	E-6	1,011	Tazewell
Hamilton	A-7	1,776	Hancock	Macomb *	B-6	10,592	McDonough
Hanover	C-1	1,643	Jo Daviess	Madison	C-12	7,963	Madison
Harrisburg *	G-14	10,999	Saline	Mahomet	G-7	1,017	Champaign
Hartford	D-11	1,909	Madison	Manteno	J-4	1,789	Kankakee
Harvard	G-1	3,464	McHenry	Marengo	G-1	2,726	McHenry
Harvey	J-3	20,683	Cook	Marion *	F-14	10,459	Williamson
Havana *	D-7	4,398	Mason	Marissa	D-13	1,652	St. Clair
Hazel Crest	J-3	2,129	Cook	Markham	J-3	2,753	Cook
Henry	E-5	1,966	Marshall	Maroa	F-8	1,100	Macon
Herrin	F-14	9,331	Williamson	Marseilles	G-4	4,514	La Salle
Heyworth	F-7	1,072	McLean	Marshall *	J-9	2,960	Clark
Highland	D-11	4,283	Madison	Martinsville	H-10	1,440	Clark
Highland Park	J-1	16,808	Lake	Mascoutah	D-12	3,009	St. Clair
Highwood	J-1	3,813	Lake	Mason City	D-7	2,004	Mason
Hillsboro *	E-10	4,141	Montgomery	Matteson	J-3	1,211	Cook
Hillside	H-2	2,131	Cook	Mattoon	G-9	17,547	Coles
Hinsdale	H-3	8,676	Du Page-	Maywood	J-2	27,473	Cook
			Cook	Melrose Park	J-2	13,366	Cook
Homer	H-8	1,030	Champaign	Mendota	F-3	5,129	La Salle
Homewood	J-3	5,887	Cook	Merrionette Park	J-3	1,101	Cook
Hoopeston	J-6	5,992	Vermilion	Metamora	E-5	1,368	Woodford
Itasca	H-2	1,274	Du Page	Metropolis *	G-16	6,093	Massac
Jacksonville *	C-9	20,387	Morgan	Midlothian	J-3	3,216	Cook
Jerseyville *	C-10	5,792	Jersey	Milan	C-4	1,737	Rock Island
Johnson City	F-14	4,479	Williamson	Milford	J-6	1,648	Iroquois
Joliet *	H-3	51,601	Will	Milledgeville	D-2	1,044	Carroll
Jonesboro *	E-15	1,607	Union	Millstadt	D-12	1,566	St. Clair
Kankakee *	H-4	25,856	Kankakee	Minonk	F-5	1,955	Woodford
Keithsburg	B-5	1,006	Mercer	Moline	C-3	37,397	Rock Island
Kenilworth	J-2	2,789	Cook	Momence	J-4	2,644	Kankakee
Kewanee	D-4	16,821	Henry	Monmouth *	C-5	10,193	Warren
Kincaid	E-9	1,793	Christian	Monticello *	G-8	2,612	Piatt
Knoxville	C-5	2,209	Knox	Morris *	G-4	6,926	Grundy
Lacon *	E-5	2,020	Marshall	Morrison *	D-3	3,531	Whiteside
Ladd	F-3	1,224	Bureau	Morrisonville	E-9	1,182	Christian
La Grange	H-2	12,002	Cook	Morton	E-6	3,692	Tazewell
La Grange Park	H-2	6,176	Cook	Morton Grove	J-2	3,926	Cook
La Harpe	B-6	1,295	Hancock	Mound City *	F-16	2,167	Pulaski
La Salle	F-4	12,083	La Salle	Mounds	F-16	2,001	Pulaski
Lake Bluff	J-1	2,000	Lake	Mount Carmel *	J-12	8,732	Wabash
Lake Forest	J-1	7,819	Lake	Mount Carroll *	D-2	1,950	Carroll
Lanark	D-2	1,359	Carroll	Mount Morris	E-2	2,709	Ogle
Lansing	J-3	8,682	Cook	Mount Olive	D-10	2,401	Macoupin

* County Seat

Place	Map Coordinate	Population	County	Place	Map Coordinate	Population	County
Mount Prospect	H-2	4,009	Cook	Port Byron	C-3	1,050	Rock Island
Mount Pulaski	E-8	1,526	Logan	Posen	J-3	1,795	Cook
Mount Sterling *	B-8	2,246	Brown	Princeton *	E-4	5,765	Bureau
Mount Vernon *	F-13	15,600	Jefferson	Princeville	D-5	1,113	Peoria
Moweaqua	F-9	1,475	Shelby	Prophetstown	D-3	1,691	Whiteside
Mundelein	H-1	3,189	Lake	Quincy *	A-8	41,450	Adams
Murphysboro *	E-14	9,241	Jackson	Rantoul	H-7	6,387	Champaign
Naperville	H-3	7,013	Du Page	Red Bud	D-13	1,519	Randolph
Nashville *	E-13	2,432	Washington	Ridgway	H-14	1,148	Gallatin
Nauvoo	A-6	1,242	Hancock	Riverdale	J-3	5,840	Cook
Neoga	G-10	1,125	Cumberland	River Forest	J-2	10,823	Cook
New Athens	D-13	1,518	St. Clair	River Grove	J-2	4,839	Cook
New Baden	D-12	1,428	Clinton-St. Clair	Riverside	H-2	9,153	Cook
				Riverton	E-8	1,450	Sangamon
New Lenox	H-3	1,235	Will	Roanoke	F-5	1,368	Woodford
Newman	H-8	1,140	Douglas	Robbins	J-3	4,766	Cook
Newton *	H-11	2,780	Jasper	Robinson *	J-11	6,407	Crawford
Niles	J-2	3,587	Cook	Rochelle	F-2	5,449	Ogle
Nokomis	E-10	2,544	Montgomery	Rockdale	H-3	1,393	Will
Normal	F-6	9,772	McLean	Rock Falls	D-3	7,983	Whiteside
Norridge	J-2	3,428	Cook	Rockford *	F-1	92,927	Winnebago
Norris City	G-14	1,370	White	Rock Island *	C-3	48,710	Rock Island
Northbrook	J-1	3,348	Cook	Rockton	F-1	1,432	Winnebago
North Chicago	J-1	8,628	Lake	Roodhouse	C-9	2,368	Greene
North Chillicothe	E-5	1,741	Peoria	Roselle	H-2	1,038	Du Page
Northfield	J-2	1,426	Cook	Roseville	B-6	1,080	Warren
North Lake	H-2	4,361	Cook	Rosiclare	G-15	2,086	Hardin
North Pekin	E-6	1,758	Tazewell	Rossville	J-7	1,382	Vermilion
North Riverside	J-2	3,230	Cook	Round Lake Beach	H-1	1,892	Lake
Oak Forest	J-3	1,856	Cook	Round Lake Park	H-1	1,836	Lake
Oak Lawn	J-3	8,751	Cook	Roxana	D-11	1,911	Madison
Oak Park	J-2	63,529	Cook	Royalton	F-14	1,506	Franklin
Oblong	H-11	1,639	Crawford	Rushville *	C-7	2,682	Schuyler
Odin	F-12	1,341	Marion	St. Anne	J-5	1,403	Kankakee
O'Fallon	D-12	3,022	St. Clair	St. Charles	G-2	6,709	Kane
Oglesby	F-4	3,922	La Salle	St. Elmo	F-11	1,716	Fayette
Olney *	H-11	8,612	Richland	St. Francisville	J-12	1,117	Lawrence
Onarga	H-6	1,455	Iroquois	Salem *	F-12	6,159	Marion
Oregon *	E-2	3,205	Ogle	Sandoval	F-12	1,531	Marion
Oswego	G-3	1,220	Kendall	Sandwich	G-3	3,027	De Kalb
Ottawa *	F-4	16,957	La Salle	Savanna	D-2	5,058	Carroll
Palatine	H-2	4,079	Cook	Schiller Park	H-2	1,384	Cook
Palestine	J-11	1,589	Crawford	Sesser	F-13	2,086	Franklin
Pana	F-9	6,178	Christian	Shawneetown *	H-14	1,917	Gallatin
Paris *	J-9	9,460	Edgar	Shelbyville *	F-9	4,462	Shelby
Park Forest	J-3	8,130	Cook	Sheldon	J-5	1,114	Iroquois
Park Ridge	H-2	16,602	Cook	Silvis	C-3	3,055	Rock Island
Paxton *	H-6	3,795	Ford	Skokie	J-2	14,832	Cook
Pecatonica	E-1	1,438	Winnebago	South Beloit	F-1	3,221	Winnebago
Pekin *	E-6	21,858	Tazewell	South Chicago Hts.	J-3	2,129	Cook
Peoria *	E-6	111,856	Peoria	South Elgin	G-2	1,220	Kane
Peoria Heights	E-6	5,425	Peoria	South Holland	J-3	3,247	Cook
Peotone	J-4	1,395	Will	South Jacksonville	C-9	1,165	Morgan
Peru	F-4	8,653	La Salle	South Pekin	E-6	1,043	Tazewell
Petersburg *	D-8	2,325	Menard	Sparta	D-13	3,576	Randolph
Phoenix	J-3	3,606	Cook	Springfield *	E-8	81,628	Sangamon
Pinckneyville *	E-13	3,299	Perry	Spring Valley	E-4	4,916	Bureau
Pittsfield *	B-9	3,564	Pike	Staunton	D-11	4,047	Macoupin
Plainfield	H-3	1,764	Will	Steelville	E-14	1,353	Randolph
Plano	G-3	2,154	Kendall	Steger	J-3	4,358	Will-Cook
Polo	E-2	2,242	Ogle	Sterling	D-3	12,817	Whiteside
Pontiac *	G-5	8,990	Livingston	Stickney	J-2	3,317	Cook

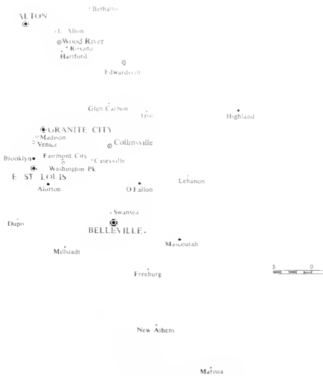
* County Seat

Place	*Map Coordinate*	*Population*	*County*	*Place*	*Map Coordinate*	*Population*	*County*
Stockton	D-1	1,445	Jo Daviess	Wauconda	H-1	1,173	Lake
Stone Park	J-2	1,414	Cook	Waukegan *	J-1	38,946	Lake
Stonington	F-9	1,120	Christian	Waverly	D-9	1,330	Morgan
Streator	F-4	16,469	La Salle-	Wenona	F-5	1,005	Marshall
			Livingston	Westchester	H-2	4,308	Cook
Sullivan *	G-9	3,470	Moultrie	West Chicago	H-2	3,973	Du Page
Summit	J-3	8,957	Cook	West City	F-14	1,081	Franklin
Sumner	J-11	1,170	Lawrence	West Dundee	H-2	1,948	Kane
Swansea	D-12	1,816	St. Clair	Western Springs	H-2	6,364	Cook
Sycamore *	G-2	5,912	De Kalb	West Frankfort	F-14	11,384	Franklin
Taylorville *	E-9	9,186	Christian	Westmont	H-3	3,402	Du Page
Thornton	J-3	1,217	Cook	Westville	J-8	3,196	Vermilion
Tilton	J-7	1,638	Vermilion	Wheaton *	H-2	11,638	Du Page
Tinley Park	J-3	2,326	Cook	White Hall	C-9	3,082	Greene
Tolono	H-8	1,065	Champaign	Willow Springs	H-3	1,314	Cook
Toluca	F-5	1,419	Marshall	Wilmette	J-2	18,162	Cook
Toulon *	D-5	1,173	Stark	Wilmington	H-4	3,354	Will
Tremont	E-6	1,138	Tazewell	Winchester *	C-9	1,591	Scott
Trenton	E-12	1,432	Clinton	Windsor	G-9	1,008	Shelby
Troy	D-11	1,260	Madison	Winnetka	J-2	12,105	Cook
Tuscola *	H-8	2,960	Douglas	Winthrop Harbor	J-2	1,765	Lake
Urbana *	H-7	22,834	Champaign	Witt	E-10	1,156	Montgomery
Vandalia *	F-11	5,471	Fayette	Wood Dale	H-2	1,857	Du Page
Venice	C-12	6,226	Madison	Wood River	D-11	10,190	Madison
Vienna *	F-15	1,085	Johnson	Woodstock *	G-1	7,192	McHenry
Villa Grove	H-8	2,026	Douglas	Worth	J-3	1,472	Cook
Villa Park	H-2	8,821	Du Page	Wyoming	D-5	1,496	Stark
Virden	D-9	3,206	Macoupin	Zeigler	F-14	2,516	Franklin
Virginia *	C-8	1,572	Cass	Zion	J-1	8,950	Lake
Walnut	E-3	1,093	Bureau-				
			Washington	COUNTY SEATS WITH POPULATIONS OF LESS THAN 1000 IN 1950			
Wamac	F-12	1,429	Marion-				
			Clinton	Elizabethtown *	G-15	583	Hardin
Warren	D-1	1,378	Jo Daviess	Hardin *	C-10	928	Calhoun
Warsaw	A-7	2,002	Hancock	Hennepin *	E-4	312	Putnam
Washington	E-6	4,285	Tazewell	Louisville *	G-11	970	Clay
Washington Park	D-12	5,840	St. Clair	Oquawka *	B-5	929	Henderson
Waterloo *	C-13	2,821	Monroe	Toledo *	H-10	905	Cumberland
Watseka *	J-5	4,235	Iroquois	Yorkville *	G-3	632	Kendall

* County Seat

LAKE, COOK, AND DU PAGE COUNTIES

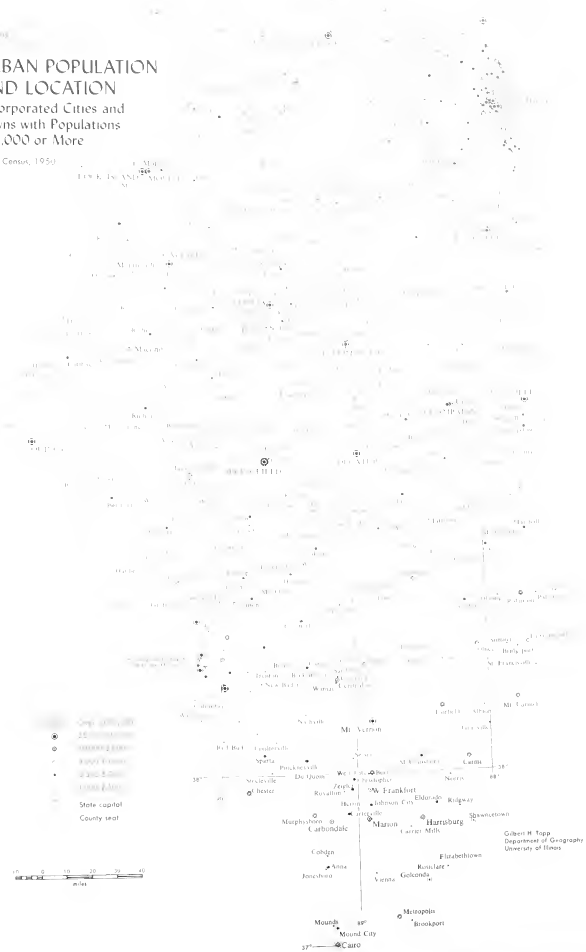
MADISON AND SAINT CLAIR COUNTIES



URBAN POPULATION AND LOCATION

Incorporated Cities and Towns with Populations of 1,000 or More

U. S. Census, 1950



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